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ABSTRACT

This instructional package is intended for use in training Air Force personnel enrolled in a program for apprentice masons. Training includes an introduction to masonry and provides instruction in the use of masons' hand, portable power, and shop tools; construction and maintenance of masonry structures using brick, concrete block, and tile; preparation of concrete, mortar and plaster mixes; placement of reinforcement steel; placement and finishing of concrete; and plaster, stucco, and tile. Military training is also provided for end-of-course appointments, predeparture safety briefing, and physical conditioning. The package contains a set of lesson plans, three study guides, and three workbooks. Included in each lesson plan are a course content outline, lists of pertinent student instructional materials, approximate times to complete each phase of the course, suggested teaching methods, and instructional guidance. The study guides consist of series of instructional units, each of which contains an objective, an introduction, instructional text, and questions. Numerous figures and diagrams illustrate the text. The accompanying workbooks include objectives, lists of needed equipment, instructions for performing various tasks, and written exercises. (MN)

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MASONRY SPECIALIST

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SHEPPARD TECHNICAL TRAINING COMMAND

CE044874

POI J3ABR55231 000
(PDS Code NDZ)

PLAN OF INSTRUCTION
(TECHNICAL TRAINING)

MASONRY SPECIALIST

SHEPPARD TECHNICAL TRAINING CENTER
30 April 1986 - Effective 21 Aug 86 with Class 860821

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LIST OF CURRENT PAGES

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DEPARTMENT OF THE AIR FORCE
USAF Technical Training School (ATC)
Sheppard Air Force Base, Texas 76311

PLAN OF INSTRUCTION J3ABR55231 000
(PDS Code NDZ)
30 April 1986

FOREWARD

1. PURPOSE: This publication is the plan of instruction (POI) when the pages listed on Page A are bound into a single volume. When separated into units of instruction, it becomes the Lesson Plan/Part I. The POI contains the qualitative requirements for course J3ABR55231, Masonry Specialist, in terms of objectives for each unit of instruction and shows planned time, training standard correlation, and support materials and guidance. This POI was developed according to ATCR 52-18, Plans of Instruction, Lesson Plans and Course Validation.

2. COURSE DESIGN/DESCRIPTION: The instructional design for this course is Group/Lock Step. The course trains airmen to perform duties prescribed in AFR 39-1 for Apprentice Mason, AFSC 55231. Training includes an introduction to masonry and provides instruction on mason's hand, portable power, and shop tools; construction and maintenance of masonry structures using brick, concrete block, and tile; preparing concrete, mortar and plaster mixes; placing reinforcement steel; and placing and finishing concrete. Deviation from the sequence of the subject matter in this plan of instruction is authorized when it is necessary to minimize the detrimental effects of adverse weather, inoperative equipment, or other factors of temporary duration which could otherwise degrade training. In addition, military training is provided for end of course appointments, pre-departure safety briefing, and physical conditioning.

3. REFERENCES: This POI is based on Specialty Training Standard, 552X1, December 1978, and Course Chart J3ABR55231 000, 1 October 1982.

William W. Miller
WILLIAM W. MILLER, Colonel, USAF
Commander, 3770 Tech Tng Gp

Supersedes Plans of Instruction J3ABR55230 000, 30 December 1982
OPR: 3770 Technical Training Group
Prepared by: Mr. Michael Young
Distribution: Listed on Page A

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Masonry Specialist

BLOCK TITLE
Introduction to Masonry

1. COURSE CONTENT	2. TIME
1. Orientation and Course Introduction	1.5/0 Day 1 (1.5/0)

1. Orientation and Course Introduction

a. Welcome

b. Overview of course content and goals

c. Inform students of benefits of the Community College of the Air Force (CCAF) and its assignment of academic credit for training at regional accredited institutions.

d. Student progress policies to include:

(1) Progress checks

(2) Written tests

(3) Special individual assistance

e. Student recognition program

f. Effective study procedures

g. Ground safety

h. Procedures for shelter exercises and fire evacuation plan

i. Student critique program

j. Energy conservation

k. Emphasize fraud, waste, and abuse program

l. Types, use and care of training literature

m. Instructions for completion of STTC Form 120, Processing Checklist-TDY Student Personnel

n. Professional Conduct and Relationships ATCR 30-4

SUPERVISOR APPROVAL OF LESSON PLAN

SIGNATURE AND DATE	SIGNATURE AND DATE

POI NUMBER	BLOCK	UNIT	DATE	PAGE NO.
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SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-I-1, Orientation and Course Introduction
SW Power Production Division/All Courses, The Air Force Fraud, Waste and Abuse Program

Training Methods
Lecture (1.5 hrs)

Instructional Guidance
Welcome students. Explain the schools chain of command. Identify locations of exits and fire extinguishers. Conduct student tour of course facilities. The following references are used in preparing this lesson: AFR 123-2, Air Force Fraud, Waste and Abuse (FW&A) Prevention and Detection; ATCR 52-3, Student Measurement; ATCR 52-26, Student Scheduling and Administration; ATCR 52-29. Student Critique Program, and ATCR 30-4, Professional Conduct and Relationships. Explain DS time and DS assignment sheet. Hand out SW Fraud, Waste and Abuse.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Masonry Specialist
BLOCK TITLE Introduction to Masonry	

1. COURSE CONTENT	2. TIME
2. Safety	1.5/1 Day 1
a. Given situations involving electrical hazards, analyze the hazard and explain the required safety precautions. STS: 6b MEAS: PC	(0/.5)
b. Identify emergency treatment for acid spills by completing the statements. STS: 6d MEAS: PC	(0/.5)
c. Given incomplete statements, specify procedures used in identification, reporting, and correcting safety hazards. STS: 6c MEAS: PC	(.5/0)
(1) Identifying safety hazards	
(2) Reporting safety hazards	
(3) Correcting safety hazards	
d. Given a situation involving a safety hazard and AF Form 457, report the hazard by completing AF Form 457 with no more than two instructor assists. STS: 6c MEAS: PC	(.5/0)
(1) AF Form 457	
(2) Completing AF Form 457	
e. Given incomplete statements, identify requirements for hazardous waste storage by completing the statements. STS: 6e MEAS: PC	(.5/0)
(1) Hazardous waste materials	
(2) Hazardous waste storage	

SUPERVISOR APPROVAL OF LESSON PLAN

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SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-I-2, Safety
WB J3ABR55231 000-I-2, Safety
DS J3ABR55231 000, Directed Study Assignments

Audio Visual Aids
35mm slides, Safety

Training Methods
Lecture/Discussion (1 hr)
Performance (.5 hr)
Directed Study (1 hr)

Instructional Guidance
Discuss the procedures for identifying, reporting and correcting safety hazards. Discuss AF Form 457 and the procedures for completing the form. Discuss the requirements for hazardous waste storage. Progress checks 2c, 2d, and 2e will be administered following each applicable presentation. Each student will be evaluated on the objectives using ATC Form 98. The grade will be an "S" for satisfactory or "U" for unsatisfactory. This grade will be placed on the ATC Form 667.

Directed Study will be assigned by the classroom instructor on day 1. The assignment will be checked at the beginning of day 2. Progress Checks 2a and 2b will be administered prior to beginning the presentation on day 2. Each student will be evaluated on the objectives using ATC Form 98. The grade will be "S" for satisfactory or "U" for unsatisfactory. This grade will be placed on the ATC Form 667.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Masonry Specialist

BLOCK TITLE
Introduction to Masonry

1. COURSE CONTENT	2. TIME
3. Maintenance of Tools and Equipment	2/1 Day 1
a. Given illustrations and statements pertaining to construction tools and equipment, identify the construction tools and equipment, their use and the care required. STS: 8a MEAS: PC	(0/1)
b. Given procedures, construction tools, machinery and working as a member of a team, make operator adjustments or repairs as necessary with no more than two instructor assists. Tools and machinery must be in safe working order and ready for use. STS: 8b MEAS: PC (1) Construction tools (2) Equipment	(.5/0)
c. Given procedures, construction tools, equipment, and working as a member of a team, sharpen the construction tools as required with no more than three instructor assists. The construction tools must be free of burrs, nicks, and ready for use. STS: 8c MEAS: PC (1) Chisels (2) Brickset	(1/0)
d. Given procedures, construction machines, tools and equipment and working as a member of a team, lubricate the tools and machines with no more than three instructor assists. All parts must move freely without binding. STS: 8d MEAS: PC (1) Handtools (2) Equipment	(.5/0)

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SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-I-3, Maintenance of Tools and Equipment
WB J3ABR55231 000-I-3, Maintenance of Tools and Equipment
DS J3ABR55231 000, Directed Study Assignments
Manufacturer's Manuals

Training Equipment
Concrete Mixer (12)
Concrete Saw (12)
Mortar Mixer (12)
Tile Saw (12)
Electric Hammer (12)
Hand tools for Masonry (2)
Electric Saw (12)

Training Methods
Lecture/Discussion (1 hr)
Performance (1 hr)
Directed Study (1 hr)

Multiple Instructor Requirements
Equipment, Supervision (2)

Instructional Guidance
Directed Study for 3a will be assigned on Day 1. The assignment will be checked at the beginning of day 2. Discuss the construction tools and equipment their selection use and care. Discuss and demonstrate the procedures for making operator adjustments or repairs. Discuss and demonstrate sharpening hand tools. Discuss and demonstrate lubrication of tools and construction machines. Progress Checks 3b, 3c, and 3d will be administered following the presentation of 3d. Each student will be evaluated on the objective using ATC Form 98. The grade will be "S" for satisfactory or "U" for unsatisfactory. This grade will be placed on ATC Form 667.

MIR: For a class size greater than 6 students, the class will be divided into two groups for 1 hour in day 1 to lubricate, sharpen, and repair tools and equipment and to perform preoperational inspection on masonry tools and equipment. One instructor will be required for each group to insure correct procedures are used, and students develop the desired skills.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Masonry Specialist
BLOCK TITLE Introduction to Masonry	

1. COURSE CONTENT	2. TIME
4. Project Planning	3/0 Day 1 (1/0) Day 2 (2/0)

4. Project Planning

a. Given engineering drawings demonstrate procedures for determining the type, location, and configuration of masonry work for the construction of the building. STS: 7a MEAS: PC

(1) Types of engineering drawings

(2) Interpreting engineering drawings

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-I-4, Project Planning
WB J3ABR55231 000-I-4, Project Planning
HO J3ABR55231 000-I-4-H1, Explanation of Masonry Terms
Engineering Drawings

Training Methods
Lecture/Discussion (1 hr)
Performance (2 hrs)

Instructional Guidance
Discuss building plans. Discuss the basic symbols found in the plans and their interpretation. Have students identify information from a set of drawings. Progress Check 4a will be administered following the presentation. Each student will be evaluated on the objective using ATC Form 98. The grade will be "S" for satisfactory or "U" for unsatisfactory. This grade will be placed on the ATC Form 667. Directed Study will be assigned, by the classroom instructor, before the close of each training day and the assignment will be checked the following training day prior to the days lesson. Directed Study measurement will be included in the applicable Criterion Objective's Progress Check.

SUPERVISOR APPROVAL OF LESSON PLAN

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PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR

COURSE TITLE
Masonry Specialist

BLOCK TITLE
Introduction to Masonry

1. COURSE CONTENT	2. TIME
5. Concrete Mixtures	4/1 Day 2
a. Identify materials used in preparing concrete mixtures by completing the statements. Eight of ten responses must be correct. STS: 9a MEAS: PC (1) Concrete ingredients (2) Water-to-cement ratio (3) Lime	(2/0)
b. Given procedures, tools, equipment, and working as a member of a team, measure and mix concrete ingredients and perform field tests, with no more than four instructor assists. The mixture must be uniform in color, consistency, and meet project specifications. STS: 9b, 9d MEAS: PC (1) Proportions (2) Designing (3) Machine mixing (4) Manually mixing (5) Slump Test	(2/1)

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-I-5, Concrete Mixtures
WB J3ABR55231 000-I-5, Concrete Mixtures
DS J3ABR55231 000, Directed Study Assignments

Audio Visual Aids
35mm slides, Concrete Mixtures
Training Film: FLC 46689 Principles of Quality Concrete

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SUPPORT MATERIALS AND GUIDANCE (Cont'd)

Training Equipment

Hand Tools for Mixing Concrete (2)

Training Methods

Lecture/Discussion (1.5 hrs)
Performance (2.5 hrs)
Directed Study (1 hr)

Multiple Instructor Requirements

Equipment, Supervision (2)

Instructional Guidance

Discuss the tools and equipment used to measure, mix and perform field tests for concrete mixtures. Progress Check 5a will be administered following the presentation. Each student will be evaluated on the objective using ATC Form 98, the grade will be "S" for satisfactory or an "U" for unsatisfactory. This grade will be placed on ATC Form 667.

Discuss and demonstrate measuring, mixing, and performing field tests. Demonstrate mixing and testing of concrete mixture. Progress Check 5b will be administered following the presentation. Each student will be evaluated on the objective using ATC Form 98, the grade will be "S" for satisfactory or an "U" for unsatisfactory. This grade will be placed on ATC Form 667.

Directed Study will be assigned, by the classroom instructor, before the close of each training day and the assignment will be checked the following training day prior to the days lesson. Directed Study measurement will be included in the applicable Criterion Objective's Progress Check.

MIR: For a class size greater than 6 students, the class will be divided into two groups for 2.5 hrs in day 2 to prepare and mix concrete. Two instructors are required to insure that correct procedures are used and students develop the desired skills.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Masonry Specialist

BLOCK TITLE
Introduction to Masonry

1. COURSE CONTENT	2. TIME
6. Construction Layout	6/1 Day 2
a. Given incomplete statements, determine procedures for locating, constructing and erecting forms for concrete footings, walls, ramps and steps by completing the statements. STS: 10a(1), 10a(3), 10a(4), 10a(5) MEAS: PC	(0/1) Day 3 (2/0)
(1) Hub stakes	
(2) Squaring	
(3) Batter boards	
(4) Marking elevation	
b. Given procedures, tools, materials, equipment and working as a member of a team, prepare a subgrade to receive concrete with no more than two instructor assists. Subgrade must be firm and within ± 1" of level. STS: 10d MEAS: PC	(4/0)
(1) Site preparation	
(2) Subgrades	
(3) Tools and equipment	
(4) Checking the completed work	

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-I-6, Construction Layout
WB J3ABR55231 000-I-6, Construction Layout
DS J3ABR55231 000, Directed Study Assignments

Audio Visual Aids
Training Film: MN 6719A, Building Techniques, Foundations and Concrete

Training Equipment
Masonry Hand Tools (2)

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SUPPORT MATERIALS AND GUIDANCE (Cont'd)

Training Methods
Lecture/Discussion (2 hrs)
Performance (4 hrs)
Directed Study (1 hr)

Multiple Instructor Requirements
Equipment, Supervision (2)

Instructional Guidance
Discuss the process of locating forms. Progress Check 6a will be administered following the presentation. Each student will be evaluated on the objective using ATC Form 98. The grade will be "S" for satisfactory and a "U" for unsatisfactory. This grade will be placed on ATC Form 667. Discuss and demonstrate the tools and materials used to prepare a subgrade. Progress Check 6b will be administered following the presentation. Each student will be evaluated on the objective using ATC Form 98. The grade will be an "S" for satisfactory and a "U" for unsatisfactory. This grade will be placed on ATC Form 667.

Directed Study will be assigned, by the classroom instructor, before the close of each training day and the assignment will be checked the following training day prior to the days lesson. Directed Study measurement will be included in the applicable Criterion Objective's Progress Check.

MIR: For a class size greater than 6 students, the class will be divided into two groups and each group will layout a site for slab construction. One instructor will be required for each group to insure that correct procedures are used and students develop the desired skills.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE
	Masonry Specialist

BLOCK TITLE
Introduction to Masonry

1. COURSE CONTENT	2. TIME
7. Preparing for Concrete	6/2 Day 3 (0/2) Day 4 (6/0)

a. Given procedures, tools, materials, equipment and working as a member of a team, locate, construct, and erect a slab form for concrete with no more than three instructor assists. The form must be tight, braced to eliminate movement and be within ± 1/8" of square and level. STS: 10a(2) MEAS: PC

(1) Types

(2) Application

(3) Tools and materials

(4) Methods

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-I-7, Preparing for Concrete
WB J3ABR55231 000-I-7, Preparing for Concrete
DS J3ABR55231 000, Directed Study Assignments
Textbook: Modern Masonry, Goodheart-Wilcox, Inc. Copyright 1977

Audio Visual Aids
35mm slides, Building Forms

Training Equipment
Hand Tools for Preparing for Concrete (2)

Training Methods
Lecture/Discussion (1 hr)
Performance (5 hrs)
Directed Study (2 hrs)

Multiple Instructor Requirements
Equipment, Supervision (2)

SUPERVISOR APPROVAL OF LESSON PLAN

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SUPPORT MATERIALS AND GUIDANCE (Cont'd)

Instructional Guidance
Discuss and demonstrate the tools, materials and equipment used to locate, construct and erect a slab form. Progress Check 7a will be administered following the presentation. Each student will be evaluated on the objective using ATC Form 98. The grade will be "S" for satisfactory and a "U" for unsatisfactory. This grade will be placed on ATC Form 667.

Directed Study will be assigned, by the classroom instructor, before the close of each training day and the assignment will be checked the following training day prior to the days lesson. Directed Study measurement will be included in the applicable Criterion Objective's Progress Check.

MIR: For a class size greater than 6 students, the class will be divided into two groups for student performance. Each group will require one instructor to insure that correct procedures are used and students develop the desired skills.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Masonry Specialist

BLOCK TITLE
Introduction to Masonry

1. COURSE CONTENT	2. TIME
8. Reinforcement Materials	1.5/1
a. Determine procedures for the placement of anchor bolts and fastening devices in concrete by completing the statements. STS: 10g MEAS: PC	Day 4 (0/1)
b. Given a previously constructed form, procedures, tools, materials, equipment and working as a member of a team, prepare and install reinforcement materials with no more than three instructor assists. The materials must be overlapped, supported and bound. STS: 10e MEAS: PC	Day 5 (1.5/0)
(1) Reasons for reinforcement	
(2) Reinforcement	
(3) Cut/tie	

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-I-8, Reinforcement Materials
WB J3ABR55231 000-I-8, Reinforcement Materials
DS J3ABR55231 000, Directed Study Assignments
Textbook: Modern Masonry, Goodheart-Wilcox, Inc. Copyright 1977

Audio Visual Aids
35mm slides: Reinforcement Materials and Tools

Training Equipment
Hand Tools for measuring, cutting and installing reinforcement
Materials (2)

SUPERVISOR APPROVAL OF LESSON PLAN

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SUPPORT MATERIALS AND GUIDANCE (Cont'd)

Training Methods

Lecture/Discussion (.5 hr)
Peformance (1 hr)
Directed Study (1 hr)

Multiple Instructor Requirements

Equipment, Supervision (2)

Instructional Guidance

Discuss the reinforcement materials, concrete anchor bolts and fastening devices. Progress Check 8a will be administered prior to presentation on day 5. Each student will be evaluated on the objective using ATC Form 98. The grade will be "S" for satisfactory and a "U" for unsatisfactory. This grade will be placed on ATC Form 667. Discuss and demonstrate the tools and materials used to install reinforcement. Progress Check 8b will be administered following the presentation. Each student will be evaluated on the objective using ATC Form 98. The grade will be an "S" for satisfactory and a "U" for unsatisfactory. This grade will be placed on ATC Form 667.

Directed Study will be assigned, by the classroom instructor, before the close of each training day and the assignment will be checked the following training day prior to the days lesson. Directed Study measurement will be included in the applicable Criterion Objective's Progress Check.

MIR: For a class size greater than 6 students, the class will be divided into two groups to measure, cut, and install reinforcement materials. One instructor will be required for each group to insure that correct procedures are used and students develop the desired skills.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Masonry Specialist

BLOCK TITLE
Introduction to Masonry

1. COURSE CONTENT	2. TIME
9. Mixing and Placing Concrete	4.5/1 Day 4
a. Given a previously constructed slab form, workable concrete, tools, materials, equipment and working as a member of a team, select the tools and place the concrete with no more than three instructor assists. The concrete must be placed as near the final position as possible. STS: 8a, 10f MEAS: PC (1) Placing (2) Tools/equipment	(0/1) Day 5 (1.5/0)
b. Given freshly placed concrete, tools, materials, equipment and working as a member of a team, select the tools and consolidate the concrete using hand tampers, spading tools and straight edges with no more than two instructor assists. The concrete must be within + 1/8" of level and all aggregate embedded. STS: 8a, 10h(1), 10h(2), 10h(3) MEAS: PC (1) Consolidating (2) Tools/equipment	(1.5/0)
c. Given consolidated concrete, tools, materials, equipment and working as a member of a team, finish the concrete using a stright-edge, bull float, hand trowel, edger, groover and brush (broom) with no more than four instructor assists. Finished concrete must be within + 1/8" of level, free of aggregate and uniformly patterned. STS: 10i(1), 10i(2), 10i(3), 10i(4), 10i(5), 10i(7) MEAS: PC (1) Finishing (2) Procedures	(1.5/0)

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SUPPORT MATERIALS AND GUIDANCE (Cont'd)

Student Instructional Materials
SG J3ABR55231 000-I-9, Mixing and Placing Concrete
WB J3ABR55231 000-I-9, Mixing and Placing Concrete
DS J3ABR55231 000, Directed Study Assignments
Textbook: Modern Masonry, Goodheart-Wilcox, Inc. Copyright 1977

Audio Visual Aids
35mm slides, Concreting
35mm slides, Mixing and Placing Concrete for a Slab

Training Equipment
Concrete Mixer (12)
Hand Tools for Mixing and Placing Concrete (2)

Training Methods
Lecture/Discussion (1 hr)
Performance (3.5 hrs)
Directed Study (1 hr)

Multiple Instructor Requirements
Equipment, Supervision (2)

Instructional Guidance
Discuss and demonstrate the tools and methods used to place, consolidate and finish concrete. Progress Checks 9a, 9b and 9c will be administered following the presentation of 9c. Each student will be evaluated on the objective using ATC Form 98. The grade will be "S" for satisfactory and a "U" for unsatisfactory. This grade will be placed on ATC Form 667.

Directed Study will be assigned, by the classroom instructor, before the close of each training day and the assignment will be checked the following training day prior to the days lesson. Directed Study measurement will be included in the applicable Criterion Objective's Progress Check.

MIR: For a class size greater than 6 students, the class will be divided into two groups for 3.5 hours in day 5 to mix, place and finish concrete. One instructor is required for each group to insure that correct work procedures are used and students develop the desired skills.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE
	Masonry Specialist

BLOCK TITLE
Introduction to Masonry

1. COURSE CONTENT	2. TIME
10. Curing Concrete	1/0 Day 6 (1/0)

10. Curing Concrete

a. Given procedures, a freshly finished slab, tools, materials, equipment and working as a member of a team, cure a concrete slab using water, sand, fabric and water proof paper with no more than two instructor assists. The concrete slab must retain moisture for a minimum of three days. STS: 10k(1), 10k(2), 10k(3) MEAS: PC

(1) Protection

(2) Methods

SUPPORT MATERIALS AND GUIDANCE

SG J3ABR55231 000-I-10, Curing Concrete
WB J3ABR55231 000-I-10, Curing Concrete
Textbook: Modern Masonry, Goodheart-Wilcox, Inc. Copyright 1977

Audio Visual Aids
35mm slides, Curing Concrete

Training Equipment
Hand Tools for Curing Concrete (2)

Training Methods
Lecture/Discussion (.5 hrs)
Performance (.5 hrs)

Multiple Instructor Requirements
Equipment, Supervision (2)

Instructional Guidance
Discuss and demonstrate the methods for curing concrete. Progress Check 10a will be administered following the presentation. Each student will be evaluated on the objective by using ATC Form 98. The grade will be "S" for satisfactory and "U" for unsatisfactory. The grade will be placed on ATC Form 667.

MIR: For a class size greater than 6 students, the class will be divided into two groups for .5 hour in Day 6 to cure concrete slab. One instructor will be required for each group to insure that correct work procedures are used and students develop the desired skills.

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PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR

COURSE TITLE Masonry Specialist

BLOCK TITLE Introduction to Masonry

1. COURSE CONTENT	2. TIME
11. Concrete Maintenance and Repairs	3/0 Day 6
a. Given a hardened concrete slab, tools, materials, equipment and working as a member of a team, remove the forms and make patches as necessary with no more than four instructor assists. The forms should be removed so as not to damage the concrete, and all voids will be repaired to match existing concrete. STS: 10j MEAS: PC	(.5/0)
(1) Form removal	
(2) Sequence	
(3) Cleaning, oiling, storing	
(4) Patching	
b. Given incomplete statements, determine the procedures for cutting, breaking or drilling concrete using an impact hammer by completing the statements. STS: 101(4) MEAS: PC	(.5/0)
(1) Uses	
(2) Operation	
c. Given a damaged section of concrete, procedures, tools, equipment, materials and working as a member of a team, cut, break, or drill the damaged section using a concrete saw, drill and paving breaker with no more than three instructor assists. The section must be free of concrete and reinforcement materials. STS: 101(1), 101(2), 101(3) MEAS: PC	(1/0)
(1) Inspecting and determing damaged areas	
(2) Methods of removal	
d. Given power tools, materials, equipment and working as a member of a team, exercise safety precautions while using and maintaining construction tools and equipment, and while operating electrically and pneumatically powered tools. STS: 6a(1), 6a(2), 6a(5) MEAS: PC	(1/0)
(1) Electrically powered tool safety	
(2) Pneumatically powered tool safety	

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SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-I-11, Concrete Maintenance and Repairs
WB J3ABR55231 000-I-11, Concrete Maintenance and Repairs
Textbook; Modern Masonry, Goodheart-Wilcox, Inc. Copyright 1977

Audiovisual Aids
35mm slides, Concrete Maintenance and Repairs

Training Equipment
Pavement Breaker (12)
Air Compressor (12)
Concrete Saw (12)
Hand Tools for Concrete Maintenance (2)
Electric Hammer (12)

Training Methods
Lecture/Discussion (1 hr)
Performance (2 hrs)

Multiple Instructor Requirements
Equipment, Supervision (2)

Instructional Guidance
Discuss and demonstrate the procedures for removing forms and patching, also procedures for cutting, breaking and drilling damaged concrete. Reinforce safety precautions while using and maintaining construction tools and equipment and while operating electrically and pneumatically powered tools. Discuss and demonstrate the methods of inspecting damaged or unsafe concrete Progress Checks 11a and 11b will be administered after each applicable objective and 11c and 11d, will be administered following the presentation of 11d. For Progress Check 11a, divide the class into two groups and have each group remove the forms and make patches as necessary for Progress Check 11c, and 11d divide the class into groups and have them safely cut, break or drill a damaged section of concrete.

The following reference should be used when preparing the lesson:
Textbook: Modern Masonry, Goodheart-Wilcox, Inc. Copyright 1977

MIR: For a class size greater than 6 students the class will be divided into 2 groups for 2 hours in Day 6 to remove and store forms, finish a concrete surface, and inspect and repair a concrete structure. One instructor will be required for each group to insure correct work procedures are used and students develop the desired skills.

12. Written Test and Test Critique 2/0

13. MT: Physical Conditioning 0/2

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Masonry Specialist

BLOCK TITLE
Block and Brick Construction

1. COURSE CONTENT	2. TIME
1. Cutting Masonry	3/2
a. Given procedures, tools, materials and equipment, cut brick and block using hammers, chisels, brick set, trowels, and masonry saw with no more than four instructor assists. The finished cuts must be within ± 1/4" of specifications. STS: 11a(1), 11a(2), 11a(3), 11a(4), 12a(1), 12a(2), 12a(3), 12a(4) MEAS: PC	Day 6 (0/2) Day 7 (3/0)

(1) Tools/equipment

(2) Cutting masonry

(30 Safety

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-II-1, Cutting Masonry
WB J3ABR55231 000-II-1, Cutting Masonry
DS J3ABR55231 000, Directed Study Assignments
Textbook: Modern Masonry, Goodheart-Wilcox, Inc. Copyright 1977

Audio Visual Aids
35mm slides, Cutting Masonry

Training Equipment
Masonry Saw (12)
Hand Tools for Cutting Masonry (2)

Training Methods
Lecture/Discussion (1 hr)
Performance (2 hrs)
Directed Study (2 hrs)

Multiple Instructor Requirements
Equipment, Supervision (2)

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Instructional Guidance

Discuss and demonstrate the various tools and equipment used to cut and shape brick and block. Administer progress check 1a following the presentation. Each student will be evaluated on the objective using ATC Form 98. Grade will be an "S" for satisfactory or "U" for unsatisfactory. This grade will be placed on the ATC Form 667.

MIR: For a class size greater than 6 students, the class will be divided into 2 groups to saw, cut and shape blocks and bricks. Two instructors will be required to insure that correct work procedures are used and students develop the desired skills.

Directed Study will be assigned, by the classroom instructor, before the close of each training day and the assignment will be checked the following training day prior to the days lesson. Directed Study measurement will be included in the applicable Criterion Objective's Progress Check.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Masonry Specialist

BLOCK TITLE
Block and Brick Construction

1. COURSE CONTENT	2. TIME
2. Concrete Block Construction	21/6
a. Given procedures, a concrete slab, tools, materials and working as a member of a team, clean and prepare the surface for mortar with no more than three instructor assists. The surface must be clean, properly marked, and ready to receive mortar. STS: 11c, 12c MEAS: PC	Day 7 (3/0)
(1) Modular design	
(2) Clean	
(3) Measuring procedures	Day 7 (0/1)
b. Given a workable mortar mix, tools, materials and working as a member of a team, perform field tests and maintain proper consistency while using mortar with no more than two instructor assists. The mortar must retain its consistency, workability and adhesiveness. STS: 9d, 11b, 12b MEAS: PC	Day 8 (.5/0)
(1) Field test	
(2) Stiffened mortar	
(3) Retemper	Day 7 (0/1)
c. Given procedures, tools, materials and working as a member of a team, add lime to previously mixed mortar with no more than two instructor assists. The mortar must have workability and adhesiveness. STS: 9c(1) MEAS: PC	Day 8 (.5/0)
(1) Lime	
(2) Safety	
d. Given procedures, tools, materials and working as a member of a team, check horizontal and vertical alignment of structural tile and block using levels and straightedges with no more than four instructor assists. The completed work must be within ± 1/4' of plumb and level. STS: 12d, 12e(1), 12e(2) MEAS: PC	(5/1) Day 9 (3/0)

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(1) Preparing mortar

(2) Spreading mortar

(3) Corner leads

(4) Horizontal/vertical alignment

e. Given procedures, previously constructed corners, tools, materials and working as a member of a team, construct a block and tile wall using plumb bobs and mason lines with no more than four instructor assists. The completed wall must be within ± 1/4" of plumb and level. STS: 12d, 12e(3) MEAS: PC Day 8 (0/1) Day 9 (3/0) Day 10 (3.5/0)

(1) Handling the block

(2) Positioning the block

(3) Laying to the line

f. Given procedures, tools, materials and working as a member of a team, shape freshly placed mortar joints for block and tile with no more than two instructor assists. All joints must be compacted, free of voids, and uniform. STS: 12g MEAS: PC Day 10 (.5/0)

(1) Tooling

(2) Tooling Operation

g. Given tools, materials and working as a member of a team, clean mortar stains from block and tile surfaces with no more than two instructor assists. All mortar stains must be removed. STS: 12h MEAS: PC Day 10 (.5/0)

(1) Cleaning

(2) Reasons

h. Given procedures, materials and working as a member of a team, construct, erect, and remove scaffolding with no more than two instructor assists. STS: 10b MEAS: PC Day 9 (0/2) Day 10 (1/0)

(1) Erection

(2) Removal

i. Given construction tools, equipment, a task and working as a member of a team, exercise safety precautions while working on scaffolds, and while lifting heavy or cumbersome loads. STS: 6a(3), 6a(4) MEAS: PC (.5/0)

(1) Safe working habits

(2) Wearing safety equipment

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-II-2, Concrete Block Construction
WB J3ABR55231 000-II-2, Concrete Block Construction
DS J3ABR55231 000, Directed Study Assignments
Textbook: Modern Masonry, Goodheart-Wilcox, Inc. Copyright 1977

Audio Visual Aids
Tape/Slide FLC 2-0211, Basic Block Laying

Training Equipment
Mortar Mixer (2)
Mortar Box (12) Hand Tools for Cutting Masonry (2)
Mortar boards (6)

Training Methods
Lecture/Discussion (4 hrs)
Demonstration/Performance (17 hrs)
Directed Study (6 hrs)

Multiple Instructor Requirements
Equipment, Supervision (2)

Instructional Guidance
Discuss and demonstrate the methods of laying out and constructing a concrete block/tile project. For criterion objective 2a, divide the class into two groups and have each group layout a site and chase the bond for a concrete block/tile project. For criterion objectives 2b, 2c, 2d, divide the class into groups and have each group build corners for a concrete block and structural tile project. For objective 2e, divide the class into groups and have each group build a structural tile and block wall. For objective 2f, the students are to shape the mortar joints, and for objective 2g, they are to clean block tile. For objective 2h, the students are to erect sectional steel scaffolding. For objective 2i, students are to exercise all safety precautions while working with scaffolds and while lifting.

Progress check 2a will be administered following the presentation. Progress checks 2b and 2c will be administered after presentation 2c. Progress check 2d will be administered after presentation. Progress check 2e and 2f will by administered after presentation 2f. Progress check 2h and 2i will be administered concurrently after presentation 2i. Each student will be evaluated on the objective using ATC Form 98. The grade will be an "S" for satisfactory or "U" for unsatisfactory. This grade will be placed on the ATC Form 667.

MIR: For a class size greater than 6 students, the class will be divided into 2 or more groups for days 7, 8, 9, 10. Two instructors will be required to ensure that each student accomplishes the required instructional objectives and develops the desired skills.

Directed Study will be assigned, by the classroom instructor, before the close of each training day and the assignment will be checked the following training day prior to the days lesson. Directed Study measurement will be included in the applicable Criterion Objective's Progress Check.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE
	Masonry Specialist

BLOCK TITLE
Block and Brick Construction

1. COURSE CONTENT	2. TIME
3. Brick Construction	21/6
a. Given procedures, tools, materials and working as a member of a team, check horizontal and vertical alignment of brick using levels and straightedges with no more than four instructor assists. The completed work must be within ± 1/4" of plumb and level. STS: 11d, 11e(1), 11e(2) MEAS: PC	Day 10 (0/2) Day 11 (6/0)
(1) Types of brick	
(2) Characteristics of brick	
(3) Bonding	
(4) Brick corners	
b. Given procedures, previously constructed corners, tools, materials and working as a member of a team, construct a brick wall using plumb bobs and mason lines with no more than four instructor assists. The completed wall must be within ± 1/4" of plumb and level. STS: 11d, 11e(3) MEAS: PC	Day 11 (0/2) Day 12 (6/2) Day 13 (6/0)
(1) Laying to the line	
(2) Procedures	
c. Given procedures, tools, materials and working as a member of a team, shape freshly placed mortar joints for a brick project with no more than two instructor assists. All joints must be compacted, free of voids, and uniform. STS: 11g MEAS: PC	Day 14 (3/0)
(1) Tooling	
(2) Tooling operation	

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SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-II-3, Brick Construction
WB J3ABR55231 000-II-3, Brick Construction
DS J3ABR55231 000, Directed Study Assignments
Textbook: Modern Masonry, Goodheart-Wilcox, Inc. Copyright 1977

Audio Visual Aids
Tape/slide FLC 2-0212, Basic Bricklaying
Tape/slide FLC 12-0157, Laying of Headers, Rowlocks and Soldiers
Tape/slide FLC, 1-0344, Arch Construction Methods

Training Equipment
Mortar Mixer (12)
Mortar Box (12)
Hand Tools for Brick Construction (2)
Mortar Boards (6)

Training Methods
Lecture/Discussion (4 hrs)
Performance (17 hrs)
Directed Study (6 hrs)

Multiple Instructor Requirements
Equipment, Supervision (2)

Instructional Guidance
Discuss and demonstrate how to construct a brick project. For criterion objectives 3a, 3b, and 3c, the class will be divided into two groups and each group will build a brick project. Progress checks are to be administered concurrently following presentation 3c. Each student will be evaluated on the objective using ATC Form 98. The grade will be an "S" for satisfactory or "U" for unsatisfactory. This grade will be placed on the ATC Form 667.

MIR: For a class size greater than 6 students, the class will be divided into 2 groups for 17 hours in days 11, 12, 13, and 14 to accomplish criterion objectives 3a, 3b and 3c. Two instructors will be required for this time to insure that correct work procedures are used and students develop the desired skills.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE
	Masonry Specialist

BLOCK TITLE
Block and Brick Construction

1. COURSE CONTENT	2. TIME

4. Maintenance and Repair of Masonry Structures 7/2
Day 14

a. Given tools, materials and working as a member of a team, seal joints and cracks in brick, block and tile with no more than two instructor assists. The joints and cracks must be uniform and watertight. STS: 11j, 12j MEAS: PC (3/0)

(1) Repointing

(2) Procedures

b. Given tools, materials and working as a member of a team, apply waterproof and dampproof materials to the surface of brick and block with no more than two instructor assists. The waterproof and dampproof materials must be applied evenly and the surfaces must be watertight. STS: 11i, 12i MEAS: PC (0/2) Day 15 (4/0)

(1) Causes

(2) Methods

(3) Above ground

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-II-4, Maintenance and Repair of Masonry Structures
WB J3ABR55231 000-II-4, Maintenance and Repair of Masonry Structures

Training Equipment
Hand tools for repair of Masonry Structures (2)

Training Methods
Lecture/Discussion (2 hrs)
Performance (5 hrs)
Directed Study (2 hrs)

Multiple Instructor Requirements
Equipment, Supervision (2)

SUPERVISOR APPROVAL OF LESSON PLAN

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Instructional Guidance

Discuss and demonstrate how to inspect, clean, and repair cracks and joints in concrete blocks, tile and brick surfaces. Divide the class into two groups and have them complete criterion objective 4a. Discuss and demonstrate how to dampproof and waterproof masonry walls. Divide the class into two groups and have them accomplish criterion objective 4b. Progress checks are to be administered following each applicable objective. Each student will be evaluated on the objective using ATC Form 98. The grade will be an "S" for satisfactory or "U" for unsatisfactory. This grade will be placed on the ATC Form 667.

MIR: For a class size greater than 6 students, the class will be divided into two groups for 2 hours in Day 14 to accomplish criterion objective 4a. The class will be divided into two groups for 3 hours in Day 15 to accomplish criterion objective 4b. Two instructors will be required for a total time of 5 hours to insure that each student accomplishes the required instructional objectives and develops the required skills.

5. Written Test and Test Critique	2/0
6. MT: Physical Conditioning	0/4

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Masonry Specialist

BLOCK TITLE
Plaster, Stucco, and Tile

1. COURSE CONTENT	2. TIME
1. Security	0/1
a. Given a list of operational activities related to AFSC 552X1, select the activities that indicate OPSEC vulnerabilities. Four of five responses must be correct. STS: 2b(6) MEAS: PC	Day 15 (0/1)

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-III-1, Security
WB J3ABR55231 000-III-1, Security
DS J3ABR55231 000, Directed Study Assignments

Training Methods
Directed Study (1 hr)
Performance (0 hr)

Instructional Guidance
Progress Check 1a will be administered prior to presentation on day 16. Each student will be evaluated on the objective using ATC Form 98. The grade will be "S" for satisfactory or "U" for unsatisfactory. This grade will be recorded on ATC Form 667.

Directed Study will be assigned, by the classroom instructor, before the close of each training day and the assignment will be checked the following training day prior to the days lesson. Directed Study measurement will be included in the applicable Criterion Objective's Progress Check.

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PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE
	Masonry Specialist

BLOCK TITLE
Plaster, Stucco, and Tile

1. COURSE CONTENT	2. TIME

2. Civil Engineering Organization 0/2 Day 17

a. Given incomplete and matching statements, identify the mission, organization, functions, and responsibilities of CE units. Eight of ten responses must be correct. STS: 5a, 5b MEAS: PC (0/.5)

b. Given a list of statements pertaining to property accountability, and a list pertaining to responsibilities of property, match the responsibilities to the accountability. Seven of ten responses must be correct. STS: 5c MEAS: PC (0/.2)

c. Given a list of Civil Engineer shops, identify the shops that pertain to the structural/pavements career field. Seven of ten responses must be correct. STS: 1a MEAS: PC (0/.5)

d. Given incomplete statements pertaining to career ladder progression, complete the statements. Three of five responses must be correct. STS: 1c MEAS: PC (0/.5)

e. Given a list of Mason and Civil Engineering duties and responsibilities, indicate the masons duties and responsibilities in accordance with AFR 39-1. Seven of ten responses must be correct. STS: 1b MEAS: PC (0/.3)

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-III-2, Civil Engineering Organization
WB J3ABR55231 000-III-2, Civil Engineering Organization
DS J3ABR55231 000 Directed Study Assignments

Training Methods
Directed Study (2 hrs)
Performance (0 hr)

Instructional Guidance
Directed Study will be assigned on day 17. The assignment will be checked at the beginning of day 18. Progress Checks, 2a, 2b, 2c, 2d, and 2e will be administered prior to beginning the presentation on day 18. Each student will be evaluated on the objectives using ATC Form 98. The grade will be "S" for satisfactory or "U" for unsatisfactory. This grade will be placed on ATC Form 667.

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Instructional Guidance (Cont'd)
Directed Study will be assigned, by the classroom instructor, before the close of each training day and the assignment will be checked the following training day prior to the days lesson. Directed Study measurement will be included in the applicable Criterion Objective's Progress Check.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE
	Masonry Specialist

BLOCK TITLE
Plaster, Stucco, and Tile

1. COURSE CONTENT	2. TIME
3. Applying Plaster and Stucco	24/3
a. Given procedures, tools, materials and working as a member of a team, install lath with no more than four instructor assists. The lath must be properly positioned and securely fastened. STS: 9e MEAS: PC	Day 16 (4/0)
(1) Wood	
(2) Metal	
(3) Gypsum board	
b. Given incomplete statements pertaining to the materials used in preparing plaster, complete the statements. Seven of ten responses must be correct. STS: 9a MEAS: PC	Day 15 (0/1) Day 16 (2/0)
(1) Tools	
(2) Plaster	
c. Given procedures, tools, materials and working as a member of a team, apply a scratch coat of plaster and stucco to lath material, with no more than four instructor assists. The scratch coat must be bonded to the lath and ready to recieve the brown coat. STS: 9e MEAS: PC	Day 17 (4/0)
(1) Scratch coat	
(2) Scratch coat mixtures	
(3) Application	
d. Given procedures, tools, materials and working as a member of a team, apply a brown coat of plaster and stucco, with no more than four instructor assists. The brown coat must be bonded to the scratch coat, no less than 1/4" thick, and ready to receive a finish coat or tile. STS: 9e MEAS: PC	(2/0) Day 18 (4/0)

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(1) Brown coat

(2) Mixtures

(3) Application

e. Given procedures, tools, materials and working as a member of (2/1)
a team, apply a finish coat of plaster and stucco, with no more than Day 19
four instructor assists. The finish coat must be bonded to the brown (4/0)
coat no less than 1/8" thick and have a smooth or textured surface.
STS: 9e MEAS: PC

(1) Finish coat mixtures

(2) Procedures

Day 18
f. Given procedures, tools, materials and working as a member of (0/1)
a team, perform field tests for consistency of a plaster mix, with no Day 19
more than two instructor assists. The final test must demonstrate (2/0)
the plaster's workability and adhesiveness. STS: 9d MEAS: PC

(1) Mixtures

(2) Consistencies

(3) Procedures

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials

SG J3ABR55231 000-III-3, Applying Plaster and Stucco
WB J3ABR55231 000-III-3, Applying Plaster and Stucco
DS J3ABR55231 000, Directed Study Assignments

Training Equipment

Hand Tools for Applying Plaster and Stucco (2)

Training Methods

Lecture/Discussion (3 hrs)
Performance (21 hrs)
Directed Study (3 hr)

Multiple Instructor Requirements
Equipment, Supervision (2)

Instructional Guidance
For Day 16 discuss and demonstrate the procedures necessary for installing lath, discuss the materials used in preparing plaster. Progress Checks 3a and 3b will be administered following the presentation of 3b. For Day 17, discuss and demonstrate the procedures necessary for applying a scratch coat. Progress Check 3c will be administered following the presentation. Day 18, discuss and demonstrate the procedures for applying a brown coat and for performing field tests for consistency of plaster. Progress Checks 3d and 3f will be administered following the presentation of 3f. Day 19, discuss and demonstrate the procedures for applying a finish coat. Progress Check 3e will be administered following the presentation.

Each student will be evaluated on the objective using ATC Form 98. The grade will be "S" for satisfactory or "U" for unsatisfactory. This grade will be recorded on ATC Form 667.

Directed Study will be assigned, by the classroom instructor, before the close of each training day and the assignment will be checked the following training day prior to the days lesson. Directed Study measurement will be included in the applicable Criterion Objective's Progress Check.

MIR: For a class size greater than 6 students, the class will be divided into groups in days 16, 17, 18, and 19 to accomplish criterion objectives 3a, 3b, 3c, 3d, 3e, and 3f. Two instructors will be required for 21 hours of performance to insure that correct work procedures are used and that each student accomplishes the required objectives and develops the desired skills.

NAME OF INSTRUCTOR	COURSE TITLE Masonry Specialist

BLOCK TITLE
Plaster, Stucco, and Tile

1. COURSE CONTENT	2. TIME
4. Publications	2/0 Day 20
a. Given AFR 0-2, locate standard publication numbers and titles in numerical index. Seven of ten responses must be correct. STS: 3a MEAS: PC	(.5/0)
(1) Format	
(2) Use of AFR 0-2	
b. Given a commerical publication and a list of masonry tools and equipment, locate desired information in the commercial publication. Seven of ten questions must be answered correctly. STS: 3b MEAS: PC	(.5/0)
(1) Format	
(2) Use of commerical publication	
c. Given AFR 85-1, AFM 91-31, and AFP 85-1, locate desired information in the publications. Seven of nine responses must be correct. STS: 3c MEAS: PC	(1/0)
(1) Types	
(2) Uses	

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-III-4, Publications
WB J3ABR55231 000-III-4, Publications
Publication Files

Training Methods
Lecture/Discussion (1 hr)
Performance (1 hr)

SUPERVISOR APPROVAL OF LESSON PLAN

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J3ABR55231 000	III	4	30 April 1986	41

Instructional Guidance
Discuss and demonstrate AFR 0-2, commercial publications, and Air Force Regulations, manuals, and pamphlets. Progress Checks 4a, 4b, and 4c will be administered immediately following the presentation of 4c. Each student will be evaluated on the objective using ATC Form 98. The grade will be "S" for satisfactory or "U" for unsatisfactory. This grade will be recorded on ATC Form 667.

Directed Study will be assigned by the classroom instructor, before the close of each training day and the assignment will be checked the following training day prior to the days lesson. Directed Study measurement will be included in the applicable Criterion Objective's Progress Check.

PLAN OF INSTRUCTION/LESSON PLAN PART I

NAME OF INSTRUCTOR	COURSE TITLE Masonry Specialist
BLOCK TITLE Plaster, Stucco, and Tile	

1. COURSE CONTENT	2. TIME
5. Installing Wall and Floor Tile	19/2
a. Given procedures, specifications, materials, equipment and working as a member of a team, cut and trim tile using hammers, chisels, brick set, tile cutting machines, tile nippers and carborundum stones with no more than four instructor assists. The tile must be cut and trimmed IAW specifications. STS: 13a(1), 13a(2), 13a(3), 13a(4), 13a(5) MEAS: PC	Day 19 (0/2) Day 20 (4/0)
(1) Reasons for cutting	
(2) Tools/equipment	
b. Given procedures, tools, materials and working as a member of a team, apply adhesive and position tile with no more than five instructor assists. The adhesive must be applied uniformly and the tile must bond to the surface. STS: 13b MEAS: PC	Day 21 (6/0)
(1) Preparation and layout for wall tile	
(2) Laying out the job	
(3) Tiling a wall using adhesive	
(4) Preparation and layout of floor tile	
(5) Laying out the job	
(6) Setting floor tile	

SUPERVISOR APPROVAL OF LESSON PLAN

SIGNATURE AND DATE	SIGNATURE AND DATE

POI NUMBER	BLOCK	UNIT	DATE	PAGE NO.
J3ABR55231 000	III	5/6/7/8	30 April 1986	43

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c. Given procedures, tools, materials and working as a member of a team, check horizontal and vertical alignment of tile using levels, straight edges and mason lines, with no more than three instructor assists. The tile must be evenly spaced, and within ± 1/16" of plumb and level. STS: 13c(1), 13c(2), 13c(3) MEAS: PC — Day 22 (6/0)

(1) Alignment (Wall Tile)

(2) Alignment (Floor Tile)

d. Given procedures, tools, materials and working as a member of a team, grout the tile joints with no more than four instructor assists. The joints must be compacted and free of voids. STS: 13d MEAS: PC — Day 23 (1.5)

(1) Grouting Wall Tile

(2) Grouting Floor Tile

e. Given procedures, tools, materials and working as a member of a team, clean grout stains from tile with no more than three instructor assists. All grout stains must be removed. STS: 13e MEAS: PC — (1.5)

(1) Cleaning Wall Tile

(2) Cleaning Floor Tile

SUPPORT MATERIALS AND GUIDANCE

Student Instructional Materials
SG J3ABR55231 000-III-5, Installing Wall and Floor Tile
WB J3ABR55231 000-III-5, Installing Wall and Floor Tile

Audiovisual Aids
35mm slides, Installing Wall and Floor Tile

Training Equipment
Hand Tools for Installing Wall and Floor Tile (2)
Hand Tools for Cutting and Trimming Tile (2)

Training Methods
Lecture/Discussion (5 hrs)
Performance (14 hrs)
Directed Study (2 hrs)

Multiple Instructor Requirements
Equipment, Supervision (2)

Instructional Guidance
On day 20 discuss and demonstrate the cutting and trimming of tiles using the various pieces of equipment. Students will be allowed to practice. On day 21 discuss and demonstrate procedures for appling adhesive and positioning the tile previously cut. On day 22 discuss and demonstrate means of checking horizontal and vertical alignment using levels, straight edges and mason lines. Students will continue practicing. On day 23 discuss and demonstrate joint grouting and administer Progress Checks 5a through 5d following presentation 5d. Progress Check 5e will be administered following presentation 5e Application of Progress Checks 5a through 5d will be evaluated concurrently. Once the wall is completed students will clean the grout stains for the wall (PC 5e).

Each student will be evaluated on the objectives using ATC Form 98. The grade will be "S" for satisfactory or "U" for unsatisfactroy. This grade will be placed on the ATC Form 667.

MIR: For a class size greater than 6 students, the class will be divided into two groups. Two instructors will be required for 14 hours of performance to insure that correct work procedures are used and students develop the desired skills.

6.	Written Test and Test Critique	2/0
7.	Course Critique and Graduation	1/0
8.	MT:	0/8
	a. Physical Conditioning	(0/2)
	b. End-of-Course Appointment and Predeparture Safety Briefing	(0/6)

STUDY GUIDES

J3ABR55231 000-I-1 thru I-11

TECHNICAL TRAINING

Masonry Specialist

INTRODUCTION TO MASONRY

April 1983

USAF TECHNICAL TRAINING SCHOOL
3770 Technical Training Group
Sheppard Air Force Base, Texas 76311

Designed for ATC Course Use RGL: 9.7

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Supersedes SG J3ABR55231 000-I-1 thru I-13, November 1981

3770 Technical Training Group
Sheppard Air Force Base, Texas

SG J3ABR55231 000-I-1
April 1983

ORIENTATION AND COURSE INTRODUCTION

OBJECTIVE

This study guide is designed to introduce you to course policies and explain the contents of the training program that you will be receiving while attending the Masonry Specialist Course.

INTRODUCTION

The 3770 Technical Training Group consists of four major branches. Each of these branches is responsible to conduct training in several courses. The Masonry Course belongs to one of these branches, the Power Production Branch, (see Figure 1). The Commander of the 3770 Technical Training Group is a Civil Engineer, (usually a Colonel or a Lt Colonel) who supervises assigned personnel and is responsible for the quality of training taught within the Group. As a member of any organization, it is important that you know your "Chain of Command". Your instructor will provide you with the names of these personnel. Write their names in the blank spaces opposite their titles.

Class Leader ____________________

Instructors

1. ____________________
2. ____________________
3. ____________________

Instructor Supervisor ____________________

Branch Chief ____________________

Group Commander ____________________

Wing Commander ____________________

Tech Training Center Commander ____________________

The Instructor-Supervisor coordinates all course activities with personnel at the Branch and Group. He ensures that training is conducted as set forth in course outlines and directives. He is also responsible for assigning instructor personnel to teach each unit of instruction.

Instruction can be presented by both military and civilian instructors who have as their primary goal, student learning. You should take full advantage of each instructional period by participating in class discussion, taking notes, and asking questions.

INFORMATION:

OVERVIEW OF THE MASONRY COURSE

This course consists of three (3) blocks of instruction. The blocks vary in length from 46 to 74 hours. The course length is 23 days.

In Block I of this course you will receive training on safety, maintenance of tools and equipment, and project planning. The remainder of the block will cover concrete construction. Block II training consists of the fundamentals of concrete block and brick construction. You will have actual practice in the construction of block and brick structures.

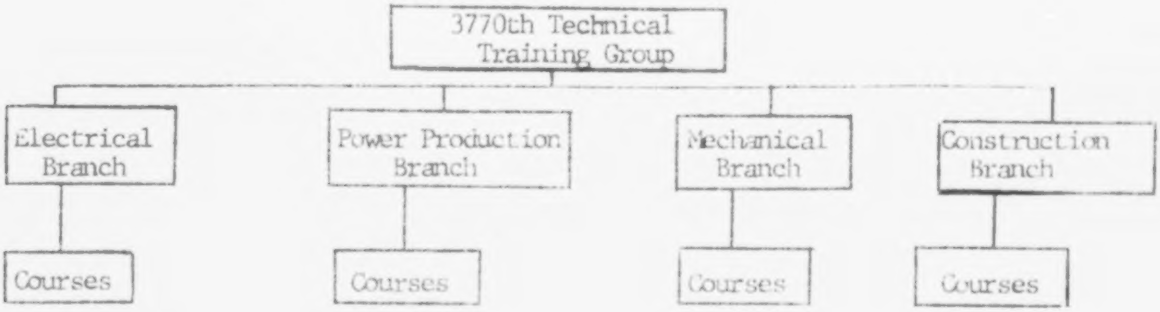


FIGURE 1. Group Structure

Block III covers security and the Civil Engineering organization which will give you the opportunity to learn about OPSEC, your career field and what to expect on the job. The majority of the block of instruction is on plaster and stucco and ceramic wall and floor tile. Block III also includes instruction on use of Air Force and commercial publications.

Community College of the Air Force (CCAF) Academic Credits

CCAF currently awards 9 semester hours of credit upon graduation from Course J3ABR55231 000, Masonry Specialist.

In addition, 4 semester hours of credit are awarded for completion of Basic Military Training. This credit may be applied in a CCAF Associate in Applied Science degree program designed for your Air Force Specialty. To register in a CCAF degree program, go to the Education Service Office (ESO) at your permanent duty station. The ESO Counselor will explain how you may earn an AAS degree in your specialty.

School Procedures and Regulations

During your enrollment in the course, you are required to abide by the procedures and regulations that govern school activities on this base. These procedures and regulations are established to provide you with the most advantageous training environment possible. This portion of the study guide is devoted to acquainting you with these procedures and regulations.

TRAINING SCHEDULE. A schedule of training activities is established by an Air Training Command regulation. The regulation requires that no less than 400 minutes per shift be spent in training. To have the best learning situation, the longest time you will sit continuously in the classroom is 60 minutes and for laboratory (performance) activity, 100 minutes. These limits may be increased for testing.

BREAKS. Breaks are authorized during the six hours of instruction so that you may take care of personal needs without missing instruction. A schedule of the authorized time for each break will be posted in the classroom area. It is your responsibility to be back in the classroom at the end of each break on time. At no time will you leave the authorized break area. Responsibility to maintain a clean break area rests with the individuals involved. You will clean up the area after each break.

APPEARANCE. You are a member of the United States Air Force. As part of this organization, as with any other, there are personal standards that you must maintain. A sharp Airman does not have to be told to get a hair cut or that his shoes need to be shined. Uniforms will be clean, neat and serviceable. Combs, pencils and unbuttoned uniforms will not be tolerated while wearing a service uniform. Discrepancies for uniform violations will result in the instructor completing an ATC Form 341 on an individual and repeated violators punished under Air Force Regulation 35-10.

SICK CALL. Routine sick call should be taken care of during the hours that school is not in session. If you should become sick while in school, you must obtain an excuse slip before leaving school. In case of serious sickness or accident, your instructor will call an ambulance immediately.

ABSENCE FROM CLASS. You may be excused from class for legitimate reasons; however, it is desirable that your personal affairs and appointments be conducted so as not to interfere with school. Requests for class excusal must be initiated through your squadron training personnel.

EMERGENCY LEAVE PROCEDURES. Inform your family that they should contact their local Red Cross in case of serious illness or a death in your immediate family. In turn, the Red Cross will notify you through your squadron, and if emergency leave is warranted, arrangements will be made for a speedy departure.

CONDUCT. Horseplay will not be tolerated. Your idea of fun may result in personal injury to yourself or another individual. Profanity is defined as conduct unbecoming and should be avoided at all times. Technically you are an adult and should act accordingly. Military bearing and conduct are a responsibility which you must maintain during your service career. A professional Airman sets examples and is noted by his superiors accordingly.

FIRE EVACUATION. Your instructor will inform you as to how a fire alarm is sounded and how to evacuate the building. The number that you should call to report a fire is standardized world-wide: it is 117.

DISASTER CONTROL PLAN. When a disaster is evident, a signal will be given to warn the base of danger. Your instructor will tell you of your designated shelter and procedures to follow.

ENERGY CONSERVATION. It is every persons responsibility to insure that we conserve energy to the fullest extent possible. If you should observe what you believe is an excessive use or waste of energy, report it to your instructor. He may be able to effect a change which could further reduce the use of energy or resources. For example, the last person out of the classroom or lab area is responsible for turning out all lights. It is everyones responsibility to conserve energy.

SMOKING. Before lighting up, be sure that you are in an authorized smoking area. Areas around the Masonry Course and Building 2013 have been designated and are marked accordingly. Do not discard smoking materials on the ground. Dispose of them in a marked receptacle. At no time discard smoking materials in a waste can or dumpster.

CLASS LEADER. A class leader will be appointed during the first day of class. This person will usually be the highest ranking individual in the class. If all members of the class have equal grade, the instructor will appoint the class leader. This individual will serve as spokesman for the class, supervise during the classroom clean up and monitor the class if the instructor has to leave the class temporarily.

Cleanup Responsibilities

All areas of instruction must be kept clean; therefore, it will be your responsibility to perform the cleanup assigned. During your tour in the course, your instructor will show you where all cleaning supplies and utilities are located. The authorized cleanup time is the 10 minutes just prior to dismissal. To do a good job, cooperation and expediency is mandatory of all personnel.

Student Critique Program

This program exists because we are interested in you and the effectiveness of your training. To critique means to give your opinion about something. We want you to express your ideas and give us your idea of ways to improve training.

Give us the good as well as the bad. The critique may be written on training, student group, or base support facilities and services. By writing the good as well as the bad, the situation can be corrected. To write a critique, use ATC Form 736. These forms are in all classrooms and in the squadron. A critique cannot be effective if it is not specific. To make a critique specific, it should state the 5 W's: who, what, where, when, why, and also how the situation can be corrected. When writing a critique, check only one block on ATC Form 736 and write only about that area so it can go to the person concerned. If you have a critique about another area, use another form (ATC 736) for your opinion. You can write a critique without any fear of prejudice or reprisal. The objective of this program is to provide commanders, supervisors, and instructors useful and necessary information upon which to base improvements. Many improvements have been made because of critiques. The critique program gives you the opportunity to participate and share in the training program.

FRAUD, WASTE, AND ABUSE (FW&A) AWARENESS

Monetary Impact

FRAUD: The General Accounting Office (GAO) recently published a three-part Report to the Congress entitled "Fraud in Government Programs: How Extensive is it?" In this report, which within Department of Defense encompassed only Army and Navy components, GAO concluded: "The total cost of fraud will never be known because of the difficulty in estimating the monetary loss due to fraud cases that remain undetected." However, based on the study of 77,210 detected fraud cases in a 2 ½- year period, they estimate monetary losses between $150 and $220 million.

Losses were detected in every agency reviewed and primarily resulted from theft, false statements, diversion of property, and false claims. Actual monetary losses ranged from $1 to as high as $2 million, but over half the losses were $1 thousand or less. Of these losses, Defense agencies accounted for about $35 million. Over 75 percent of the cases involved theft or false statements. Most thefts involved equipment or personal property. Equipment was stolen from Government buildings and installations as well as contractor plants.

False statements were made in obtaining financial assistance or benefits under many different Federal programs. Improper claims made on travel vouchers or basic allowance for quarters dependency certifications are examples. The GAO report included over 6,000 cases of food stamp irregularities.

WASTE: Wasteful practices result in little or no benefit for the dollars spent. Here are just a few examples of waste that are unfortunately too common - buying more of an item than needed; failing to use dated items before their expiration date; also, paying $8 for a $4 wrench.

ABUSE: Abuse of the leave system by failure to process leave documents costs the Government money. If the leave had been recorded, a terminal leave payment might be reduced or eliminated. Another example is using position or rank to secure benefits which are not authorized. The orders-approving official who uses Government temporary duty (TDY) to conduct personal business reduces the TDY fund balance available for legitimate purposes.

Nonmonetary Impact

The cost of fraud, waste and abuse (FW&A) cannot always be measured in dollars and cents. The nonmonetary effects must also be considered in evaluating the seriousness of incidents against the Government.

Possibly the most serious nonmonetary effect is the loss of confidence in the Government's ability to efficiently and effectively manage its resources. For example, while Government programs designed to prevent and detect FW&A have probably reduced the number of potential perpetrators within Government, these same programs have resulted in press releases of embarrassing incidents. Publicity of this sort may have mixed blessings. On the one hand, the public may tend to praise the Government for its aggressive efforts. On the other hand, incidents may confirm public predisposition to existence of FW&A within Government. All disclosures under the Freedom of Information Act carry the same potential dual interpretations.

Another serious nonmonetary effect is the impact on mission readiness of the US Air Force. This impact is hard to measure directly. Pilfered items from mobility bags may seem minor to a unit at home but become more serious when the unit is deployed and needs the missing items. What is the nonmonetary impact on unit readiness when aircraft parts in short supply are incorrectly sent to disposal or allowed to remain out of the repair cycle too long? Another example is the reluctance of managers to release unneeded items to others with a valid requirement. These actions result in reduced mission capability.

Measurement and Grading Practices

Daily quizzes are given in this course. This is done to check your progress in the course. The daily quiz scores are not used as part of your grade for the course; they are used, however, to let you and the instructor know how you are progressing in the block and if you need individual assistance in a certain area of the instruction.

The two types of measurement you will be subjected to are the Progress Check and the Written Test. Since you must complete all criterion objectives for a block of instruction prior to being administered the written test, your instructors will perform a continuing assessment of your progress in accomplishing the criterion objectives. They will observe your performance activities, insure that you complete all workbooks, and may give you short written quizzes to satisfy themselves that you have accomplished each criterion objective. Upon their satisfaction with the results of these performance tests, they will certify on the criterion checklist that you have accomplished the criterion objective in question. When you have completed all criterion objectives, they will certify that you are ready for the written test for that block of instruction.

At the end of a block you will be given a written test. This test will be a multiple-choice test. With this type of test, you will not have to write the answer, but you will have to choose the correct answer of the four answers that will be given to you. This test will determine your grade for the block of instruction. This grade will be your final block grade.

Remember, your written test score will go on your permanent course attendance record. Do the very best you can. It will be well worth the effort.

Questions missed on this test will be reviewed (critiqued) by the instructor and class to help you identify mistakes you made during testing. During this critique, you will not be permitted to take notes because the rules for protection of measurement tests are very strict. You will be informed of your test score as soon as possible after the test period.

Counseling, Washback and Elimination

If you fail a test the instructor or instructor supervisor will discuss the failure with you and will counsel you on the actions that can be taken. In these counseling sessions keep in mind that the instructor or supervisor is interested in your problems. He has nothing against you and is only trying to get at the cause of the problems and identify the area where you are having difficulty.

If you, the instructor, and the supervisor feel that you are able to do the work which you did not pass, the instructor may recommend you for the retest. Prior to re-testing, you will be given remedial (extra) instruction outside of normal class hours. After completion of the remedial instruction you will be retested and if you pass you will be given the minimum passing score for the block of instruction you are in.

If you should fail your retest, you may be considered for elimination in your best interest or in the best interest of the Air Force.

Special Individual Assistance

Special Individual Assistance (remedial instruction) is available to provide additional aid to students having difficulty in learning the course material.

The classroom instructor will work with you to set the time, dates, and location of your remedial instruction. You will be assisted during this study time by an instructor, or instructors by going over those subject areas that are causing the most difficulty.

Proficiency Advancement

Due to the length and nature of this course, a proficiency advancement program is not offered.

HONOR GRADUATE. This program is designed to serve as an incentive to reward those students who have demonstrated outstanding academic performance. Honor graduates must have maintained an excellent record of conduct in both the school and squadron. Approximately the top 10 percent of the graduates for any one year are designated as honor graduates.

INSTRUCTIONAL MATERIALS AND METHODS. Study guides and workbooks are issued to each student as an aid in understanding the subject matter. The material in these study guides does not necessarily include all the material which you are required to know. Your notes taken in class plus the training material will provide you with the necessary information. At the end of each study guide there are questions to be answered. Pencil in the answers, then return to the reading material and check your answers. The instructor may pick up and review these questions from time to time. Do not write in commercial texts that are issued for reading assignments. They will be issued to other students after you.

Instructions for performing laboratory or problem solving tasks are found in the workbooks and Technical Orders. Before starting a workbook or project, read the entire project carefully and then take each step in its proper sequence. If in doubt, be sure to question the instructor. Any questions appearing in the project or at the end of the project should be answered. Again, your instructor will check your work when completed.

TEMPORARY DUTY, AIR NATIONAL GUARD AND RESERVE STUDENTS TRAVEL ORDERS REQUIREMENT. It is necessary on the first day of school that you furnish a set of your military travel orders to the instructor. At the end of the course on day 23 you will require an additional set for turn-in. In the event you are short on the number of special orders in your possession, go to Customer Service located in Building 402. They will assist you in obtaining additional copies at no expense.

TDY PERSONNEL IN AND OUT PROCESSING. Morning shift personnel (0600-1200 or 0600-1500) - if your arrival is after normal duty hours on the day prior to class, report to class and then complete in-processing prior to the start of the second class day. The instructor will then retain your checklist until the day prior to graduation. You are required to turn-in the STTC Form 120 the last class day. You will not be given a Course Completion Diploma until your instructor has received the completed form.

SUMMARY

There are many important items involved in your training. The training literature will be study guides and workbooks. You will be given daily quizzes and a written test in this course. If you should fail the written test you will be counseled as to what actions could be taken, such as re-test. For a routine sick call, you should call for an appointment. The Red Cross will notify the squadron if an emergency occurs in your family. The CCAF is an enlisted college that gives you the opportunity to be awarded an Associate Degree. Student critiques may be written on training, student group, or base support facilities and services. The critique should be specific and should include the 5 W's. Many improvements have been made because students have written critiques. The break schedules are posted on each classroom bulletin board. You are expected to comply with the standards of AFR 35-10 for personal grooming and uniform wear at all times.

The success of the Air Force program to combat fraud, waste, and abuse (FW&A) depends to a large extent on the ability of our people to recognize FW&A coupled with their willingness to report suspected incidents.

QUESTIONS

1. How many blocks of instruction are there in this course?

2. What are two purposes of the daily quizzes?

3. What is the standard telephone number to report a fire?

4. What is the building number you are to go to in the event of a disaster warning?

5. How many semester hours of credit does the Community College of the Air Force award for this course?

REFERENCES

ATCR 52-3, Student Measurement

ATCR 52-6, Curricula Documentation

ATCR 52-11, Student Training Records and Recognition Program

ATCR 52-26, Student Scheduling and Administration

ACTR 52-29, Student Critique Program

AFR 123-2, Air Force Fraud, Waste, and Abuse (FW&A) Prevention and Detection

SAFETY

OBJECTIVE

Erect and remove a scaffold and ladder while exercising safety precautions. May have limited instructor assistance.

Life a heavy or cumbersome object from the floor to waist height. Must use correct procedures; may have instructor assistance on the hardest parts.

Given pictures containing safety hazards, identify the hazards and name the procedures for reporting or correcting them. Instructor assistance may be provided on most parts of the task.

Given information on electrical hazards and precautions, explain the procedures involved in dealing with the hazards.

Using information provided, identify the procedures for emergency treatment of person involved in acid spill.

INTRODUCTION

As an Air Force specialist or technician, you must have two primary aims in life: one, to do a first class job in your assigned duty; the other, to return to civilian life, either by discharge or retirement, in as good a physical condition as possible. A thorough knowledge of the risks confronting you, the established safety rules to protect you, and your observance of these safety rules, may determine what shape you will be in when you return to civilian life. In fact, it could be the determining factor as to whether or not you live long enough to become a civilian again.

INFORMATION

Safety is your business, my business and everybody's business. All of us must take safety very seriously. You can be very safety conscious for days and days and then let your guard down for a minute and an accident can happen. We, all must be safety conscious all of the time, not just part of the time.

Accidents are costly, not only in hurt and loss of life but in time and money. The money that the Air Force has to spend on accidents is just wasted. If there were no accidents the Air Force could save lots and lots of money each year.

A standard dictionary defines the word "accident" as "an event that takes place without foresight or expectation". This definition means that with adequate foresight most accidents can be prevented. Only 2 percent of all accidents are caused by some natural thing such as lightning, 10 percent are caused by physical hazards, and 88 percent are caused by the unsafe acts of people. This is illustrated in Figure 2.

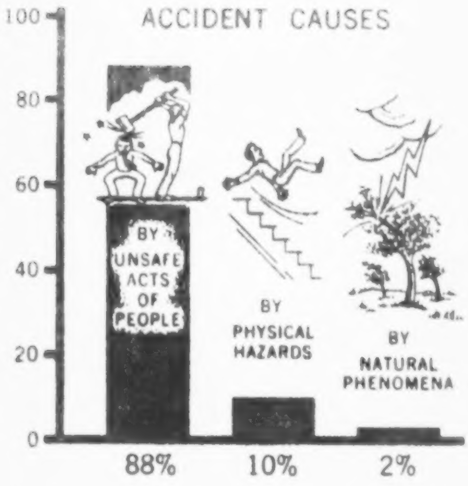


FIGURE 2. Accident Causes

General items of safety will apply to just about all duty assignments within the Air Force. To help you become more aware of the need for proper safety practices for the tools, equipment, and materials that you are not familiar with, important information is presented in the following sections on safety.

- Scaffolds
- Ladders
- Possible Effects of Not Lifting Properly
- Work Area Hazards
- Electrical Hazards and Precautions
- Acid Safety
- Emergency Treatment of Acid Spills

If you are assigned to do a task and you are not familiar with the equipment or the proper procedure you are to perform, check AFOSH Std 127-66, General Industrial Operations or other related AFOSH standards before proceeding.

SCAFFOLDS

A large part of your work will be done from a scaffold. Serious accidents have been caused by masons using scaffolds that were improperly erected or used. A scaffold which is not erected properly endangers the workers using it, and it could also become a serious danger to people who work near it.

There are many types of scaffolds that you will erect and use. A carpenter is responsible for erecting wooden scaffolds. The scaffolds you will erect range from the scaffold horse to the sectional steel scaffold and the folding lightweight aluminum stairway scaffold.

Scaffold Horse

A pair of scaffold horses with scaffold boards across them make a very useful scaffold. It is erected quickly and can be easily moved as the work progresses. The use of this type of scaffold is limited to the height of the scaffold horse.

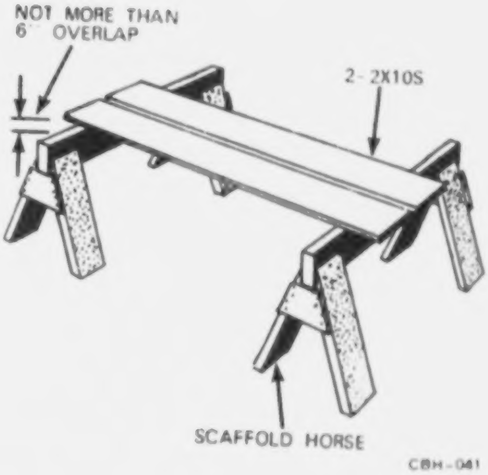


FIGURE 3. A simple scaffold

Figure 3 shows a pair of scaffold horses with two scaffold boards. These boards should be a nominal size of 2 X 10 inches. Test them by placing the ends on a support and jumping with your weight in the center of the scaffold board, as shown in Figure 4. An extension plank, such as the one shown in Figure 5 is a good substitute for the scaffold boards.

Sectional Steel Scaffold

The most popular and safest scaffold for you to use is the sectional steel scaffold. It is strongly constructed and easily assembled. It will hold heavy loads, such as you will need when laying brick or concrete block.

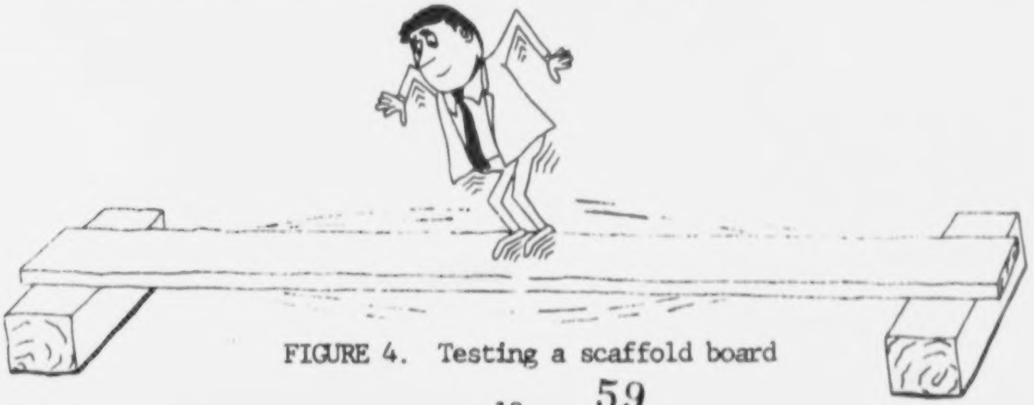


FIGURE 4. Testing a scaffold board

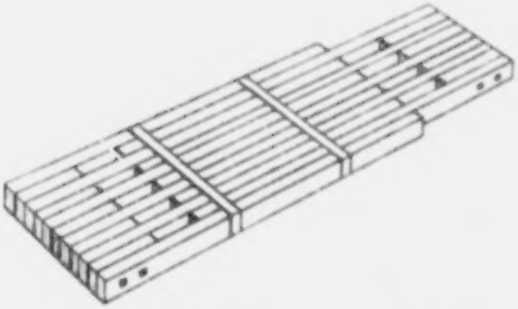


FIGURE 5. An extension plank

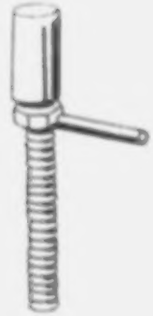


FIGURE 7. Leveling jack

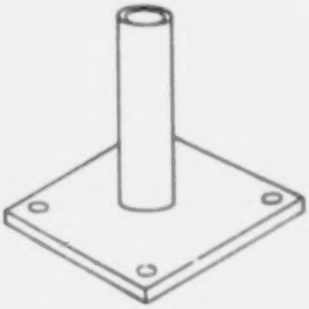


FIGURE 6. Scaffold footing plates

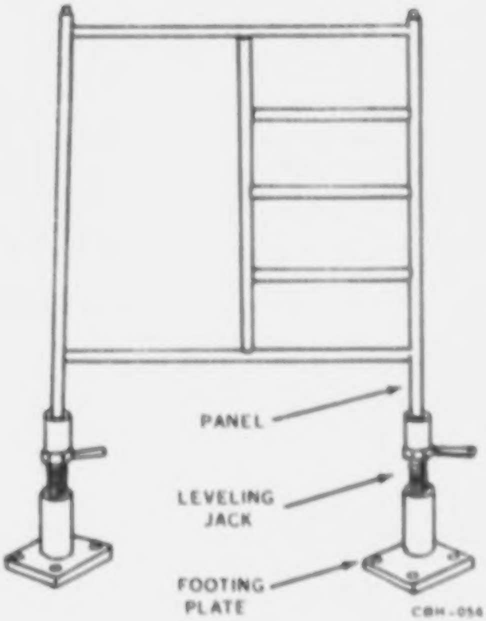


FIGURE 8. Install leveling jacks and panels into footing plates

It is erected by taking the following steps:

a. Set the footing plates as shown in Figure 6 on firm even ground or on a board to support the weight of the scaffold.

b. Insert leveling jack, as shown in Figure 7 into each footing plate.

c. Install two panels into the leveling jacks which were installed into the footing plates, as shown in Figure 8.

d. Have helpers steady the panels while you attach "X" -type pivoted braces, as shown in Figure 9. This is one basic unit.

e. Additional units can be installed until you have a scaffold as long and as tall as you need. Figure 10 shows an erected scaffold. The upright pieces of scaffold are held securely by couplings, as shown in Figure 11. Spring-loaded pins in the coupling automatically lock the sections together.

f. Sectional steel scaffolding can be constructed as high as required, but scaffolding over three sections high must be secured to the structure. One method of fastening it to the structure is shown in Figure 12. The top section must always be equipped with a guard rail and toeboard. The guard rail prevents workmen from falling, and the toeboard keeps tools and materials from falling on other workmen.

g. Side brackets as shown in Figure 13 are attached to the inside of the scaffold to support workmen. The scaffold can then be used to hold materials

h. If the scaffold is to be used on a solid floor and frequent moving is necessary, a rolling tower can be constructed of the same scaffold sections by replacing the footing plates with locking fasteners. The height of the tower must not exceed four times the smallest base dimensions, and it must be equipped with a toeboard and a guard rail above the working platform.

Aluminum Stairway Scaffold

This type of scaffolding is relatively new on the market. It is easy to set up and light to handle. It is used on light jobs, such as cleaning masonry walls. Do not use this scaffold where heavy loads are required. It is erected by taking the following steps:

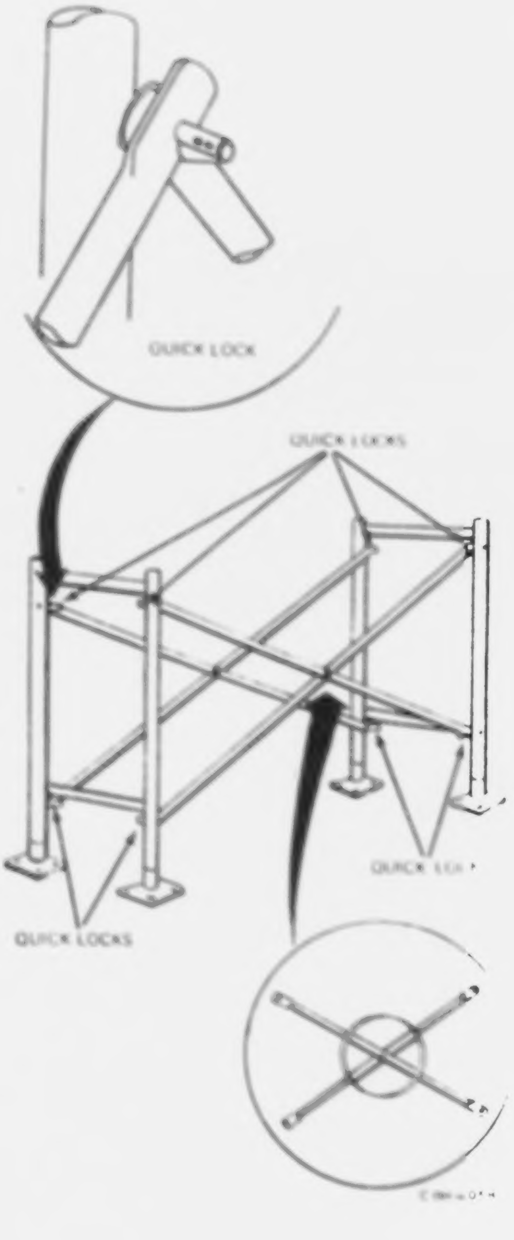


FIGURE 9. Installing braces

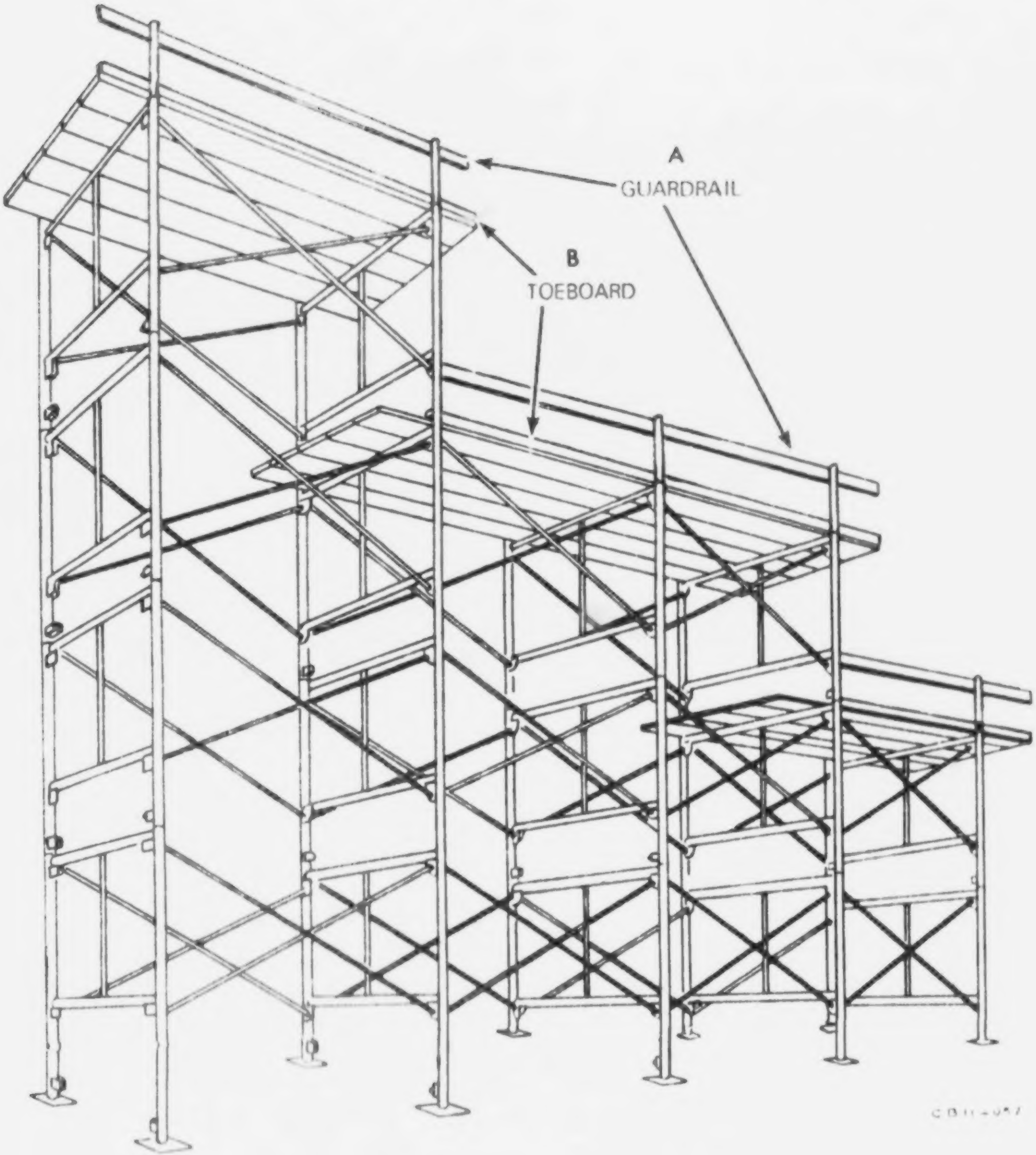

A
GUARDRAIL
B
TOEBOARD

FIGURE 10. An erected scaffold

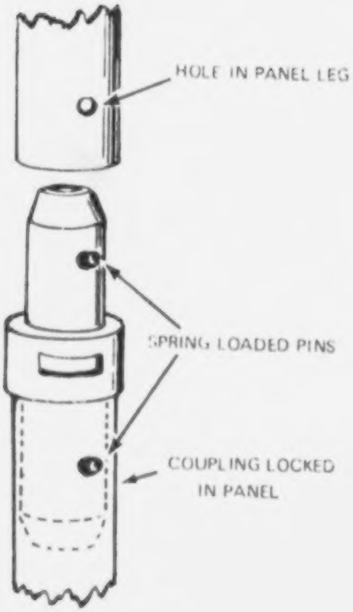

HOLE IN PANEL LEG
SPRING LOADED PINS
COUPLING LOCKED IN PANEL

FIGURE 11. Coupling

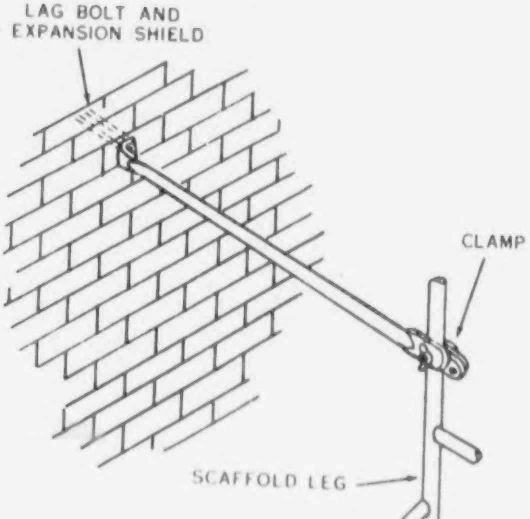

LAG BOLT AND EXPANSION SHIELD
CLAMP
SCAFFOLD LEG

FIGURE 12. Building tie-in

a. Place the adjustable section on the ground with the stairway treads facing up. Swing the top end frame over through 270° until you can snap the lower crossbar into the hooks at the bottom of the stairway, as shown in Figures 14 and 15.

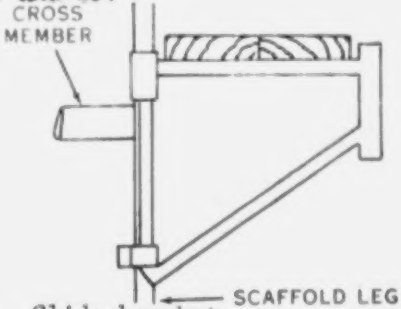

CROSS MEMBER
SCAFFOLD LEG

FIGURE 13. Slide bracket

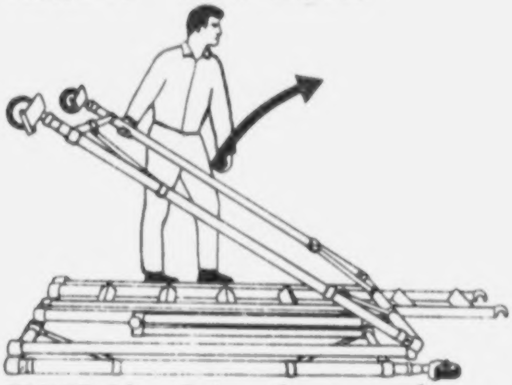


FIGURE 14. Swing the top end frame 270°

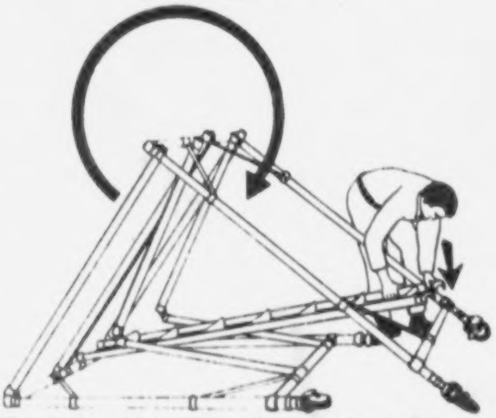


FIGURE 15. Snap the lower crossbar into the stairway hooks

b. Lift the opposite end until the end frame is vertical and the folding V-braces have opened approaching the locking position, as shown in Figure 16.

c. Make sure that both V-braces are locked. Figure 17 shows how the spring-actuated latches look when they are unlocked and when they are locked. Do not use the scaffold if any of these latches are not operating properly.

d. Level the scaffold by operating the leg adjustment, as shown in Figure 18. Never use a scaffold unless the leg adjustment is in perfect working order.

e. Before climbing the ladder, lock all caster brakes, as shown in Figure 19. Never roll the scaffold with anyone on it. Pushing the lever down sets the caster brake and moves the wheel to dead center position for maximum scaffold rigidity. The greater the load on the scaffold, the greater the braking action.

f. Place the next section against the top of the stairway of the bottom section, as shown in Figure 20. The stairway treads on this second section should face out.

g. Climb the scaffold and pull up the second section. Swing the top end frame over through 270°, as shown in Figures 21 and 22. The lower crossbar will pass under the stairway and straddle the floor braces of the lower section.

h. Raise the other end by pulling on the floor braces until the other end frame becomes vertical. Slip the legs of the frames into the sockets and lock the stairway hooks into position, as shown in Figures 23 and 24. Place the plywood platform over the locating pins on the supporting tubes.

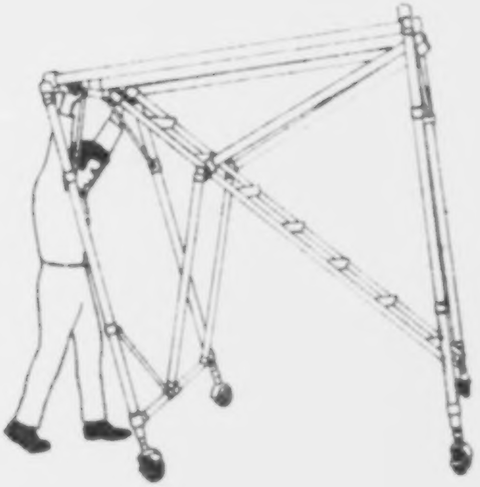


FIGURE 16. Lift the opposite end

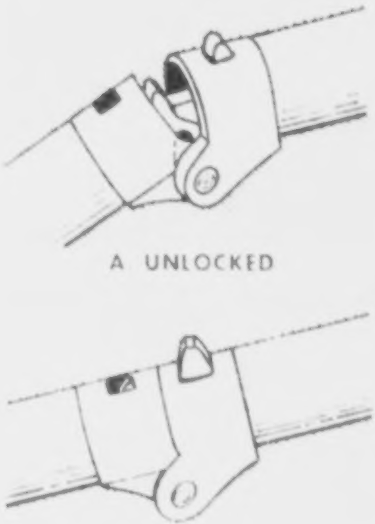


FIGURE 17. Make sure latches are locked

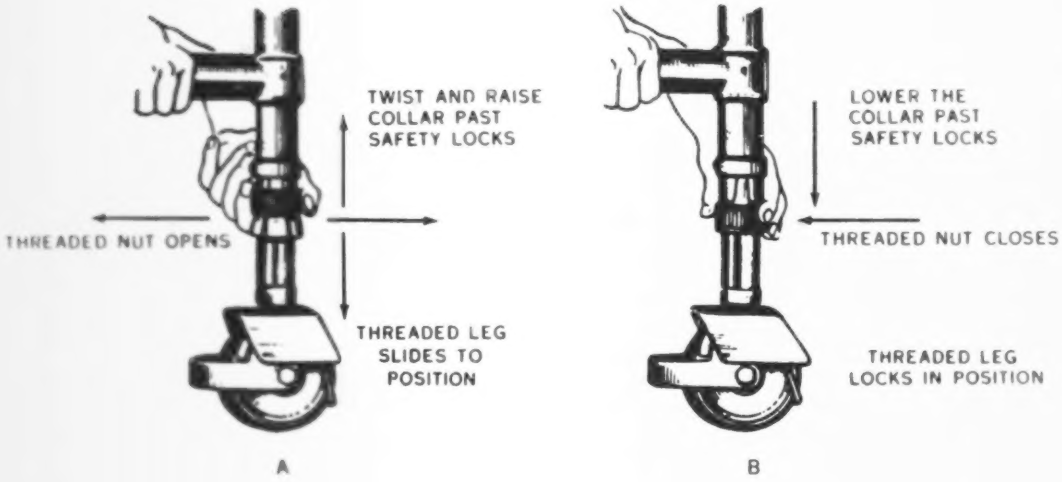

TWIST AND RAISE COLLAR PAST SAFETY LOCKS
THREADED NUT OPENS
THREADED LEG SLIDES TO POSITION
A
LOWER THE COLLAR PAST SAFETY LOCKS
THREADED NUT CLOSES
THREADED LEG LOCKS IN POSITION
B

FIGURE 18. Level the scaffold

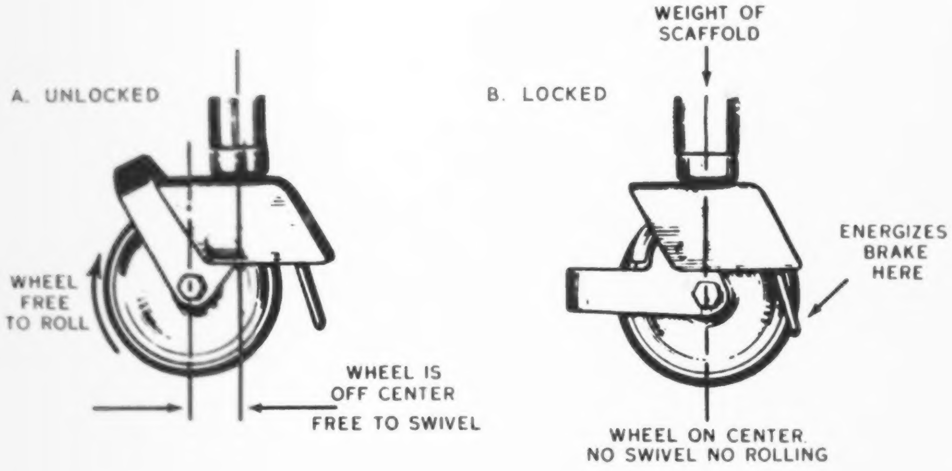

A. UNLOCKED
WHEEL FREE TO ROLL
WHEEL IS OFF CENTER
FREE TO SWIVEL
B. LOCKED
WEIGHT OF SCAFFOLD
ENERGIZES BRAKE HERE
WHEEL ON CENTER.
NO SWIVEL NO ROLLING

FIGURE 19. Lock the caster brakes

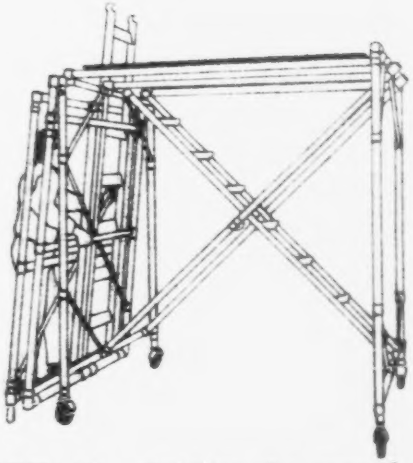


FIGURE 20. Raising the second section

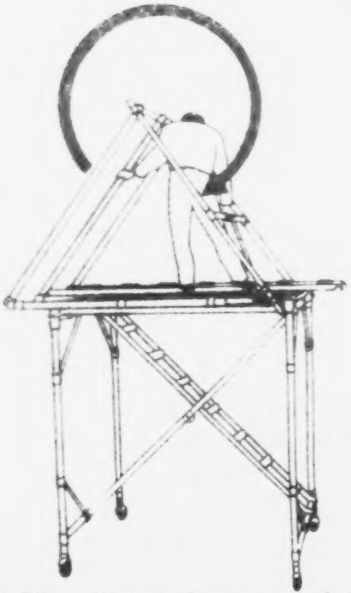


FIGURE 22. Swing the top end frame through 270°

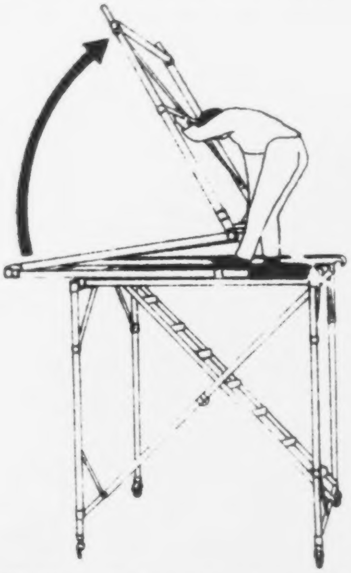


FIGURE 21. Raise the top end frame

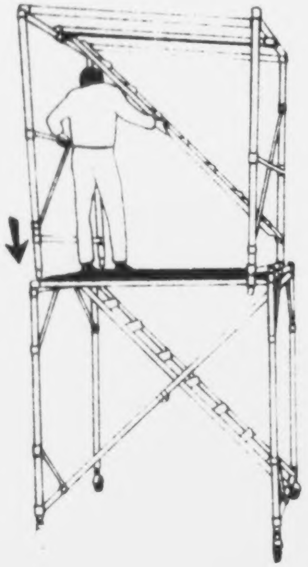


FIGURE 23. Raise the other end and slip the legs into the sockets

i. As each section is installed, move the interlock clips up to the locking holes. Figure 25 shows the interlock clip. It also shows the clip in the locked position and the stored position.

j. Place the folded half-section of safety railing on top. Unfold the end frame through 270°, as shown in Figure 26 and slip the end frame into the sockets.

k. Snap the diagonal brace into position, as shown in Figure 27. Place an additional plywood platform over the stairway opening if the additional working area is needed.

Here are some safety rules that apply to stairway scaffolds:

a. Apply all caster brakes before climbing the scaffold.

b. Never move a scaffold when anyone (or any material) is on it.

c. Be sure the scaffold is level at all times. When a leg is adjusted, be sure to push the locking collar completely over the expanding nut and below the safety locks. Never make leg adjustments when anyone is on the scaffold.

d. Don't try to "stretch" the platform height with the adjustable legs. When additional height is required, add more scaffold sections. Save the leg adjustment for leveling the scaffold.

e. Do not lean a ladder aginst a scaffold or place a ladder on the platform of a scaffold. Never push or pull or lean against the wall or ceiling when standing or sitting on a scaffold, unless it is securely tied into the building.

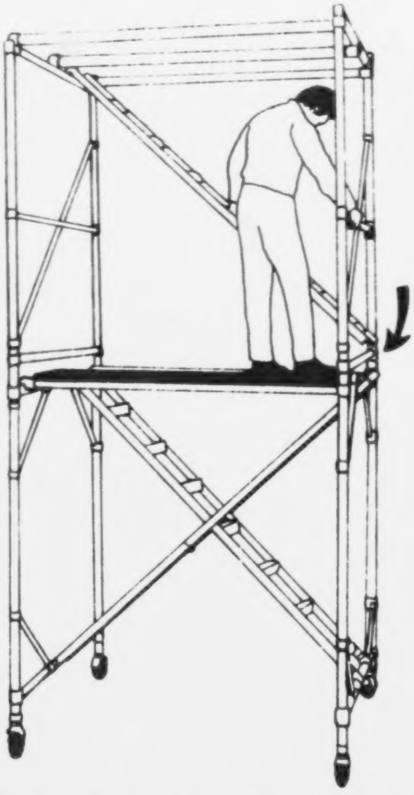


FIGURE 24. Lock the stairways hooks

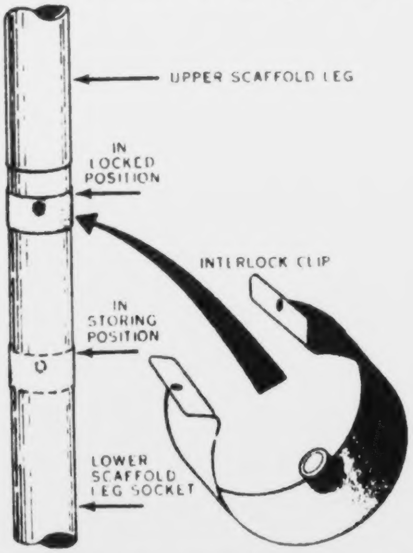
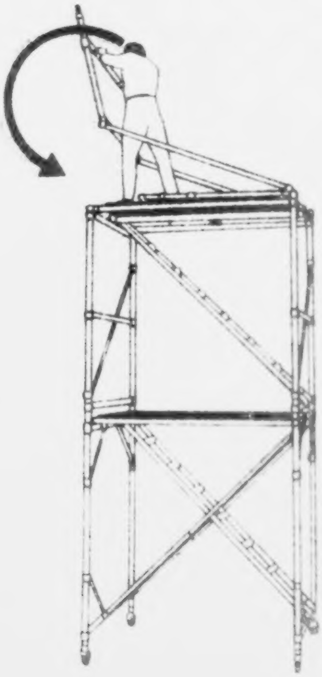


FIGURE 25. Move the interlock clip into locking position

f. Make sure all locking hooks are firmly in position and that the spring-loaded locking pins have functioned properly. These hooks appear at each end of separate horizontal and diagonal braces and at the lower end of stairways.



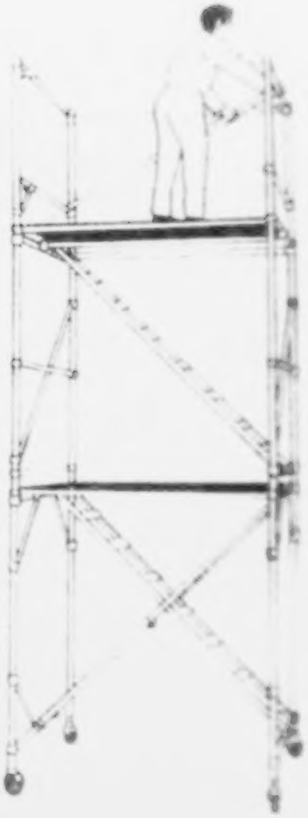


FIGURE 26. Unfold lower end frame of stairway railing through 270°

FIGURE 27. Place ends into sockets and lock diagonal brace

g. Before using a scaffold with folding braces, be sure that the latches of all locking hinges are locked.

h. Always install a safety railing and toeboard when a platform is to be used at heights of 10 feet or over.

i. When the height of a scaffold platform is going to exceed three times the minimum base dimension, the scaffold must be tied-in to the building.

j. Do not climb or stand on diagonal braces. Work only while standing on one of the platforms.

k. Never use a scaffold of any type in the vicinity of live electrical apparatus or near machinery in operation.

l. The columns of each scaffold section are furnished with interlock clips parked in the lower of a pair of holes at the upper ends. As an upper section is inserted, the interlock clips of the section below are moved to the upper section bushings interlocking the two sections. Never erect a scaffold without interlocking the sections in this manner. If interlock clips are damaged or lost, replace them immediately.

m. Never use stairways to work from; they are for personnel to walk up and down between platforms. Stairways are designed to take the weight of a 200-pound man. They are not designed to take excessive loads or abuse.

n. Never climb up the outside of a stairway scaffold. Always use the stairway for access.

o. The platform of the stairway scaffold must always be located on the floor braces by means of four locating pins. When being used outdoors or whenever the scaffold is exposed to wind or updrafts, the platform must be tied down and the scaffold secured to the building.

p. The platform of the stairway scaffold is designed to carry a maximum distributed load of 750 pounds. Do not exceed this 750-pound load.

q. When bridging between scaffolds with planks or ladder stages, place the ends of such planks or stages on the scaffold platform across both floor braces to distribute the load. The other braces of the scaffold are not designed to take heavy loads. The floor braces are the thicker tubes (approximately 1/8" wall) and have vertical pins for locating plywood platforms.

r. When erecting or taking down an upper section of the scaffold, stand in the center of the platform below and keep a firm hold on the section.

LADDERS

It is important for the mason to know how to select, erect, use and care for ladders to reach an area that cannot be reached from the ground. When you erect and use a ladder, the most important consideration is safety.

In the construction field, there are numerous serious accidents caused by ladders that are not erected or used properly. A ladder improperly erected or used incorrectly not only endangers the worker using it, but it could be a death trap for workers under or near it.

Selection of Ladders

Ladders are devices used to gain access to higher levels where work is to be done. The most common types of ladders that you will be using are the single ladder, extension ladder, and the stepladder.

The single ladder used by the mason consists of two side rails from 8 to 26 feet in length with rungs (steps) 12 inches apart. A quality ladder will support weights up to 500 pounds. The size of a ladder is determined by its overall length. Figure 28 shows a typical single wooden ladder.

The extension ladder, as shown in Figure 29, consists of two or more sections. These sections overlap and can be extended by pulling the rope. They are locked in position by the safety latch. Some extension ladders are extended by pushing the top ladder through steel guides on the bottom ladder. These extension ladders are called push-up ladders.

A stepladder is a type of ladder that is self-supporting. Figure 30 shows a sturdy stepladder. The rungs or steps should be reinforced with a steel rod running through the side rails. Be sure it is equipped with a steel spreader locking device.

Erection of Ladders

Erect a ladder by placing the base against the foundation or a solid base. Raise the top end and walk under the ladder toward the base. As soon as the ladder is perpendicular, pull the bottom out from the building to a distance of ¼ of its length, as shown in Figure 31. If you must get on top of the building or on a scaffold, the latter must extend at least 36 inches, as shown in Figure 31.

Erect extension ladders in the collapsed position. After you erect the ladder, lean the top away from the building and raise it to the desired height with the pulley-and-rope arrangement. Extension ladders must overlap to hold the sections together. The sections should overlap at least 3 feet for a ladder up to 38 feet, 4 feet up to 45 feet, and 5 feet for ladders over 45 feet. The sections are held secure with a locking device, as shown in Figure 29. Get help when erecting long, heavy ladders.

Stepladders are erected by spreading the legs and operating the locking spreader to keep the legs from folding. Be sure the ladder is on level footing.

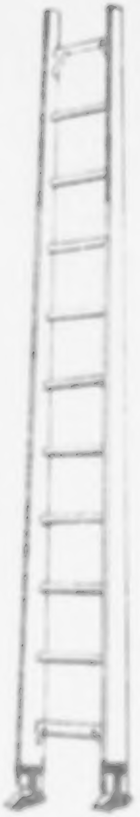


FIGURE 28. Single Ladder

Care of Ladders

Inspect ladders for defects and discard them if any defect has developed. When it is necessary for you to carry a ladder, carry it over your shoulder with the front end elevated, as shown in Figure 32. Do not drop it or allow it to fall, as the impact will weaken it. Store the ladder horizontally on hangers to prevent sagging, as shown in Figure 33. Do not store near heat or expose it to the weather elements.

Ladder Safety

Some safety precautions that you must observe when using a ladder are as follows:

a. Always inspect a ladder before using it.

b. Before climbing the ladder, be sure that both rails rest on solid footing.

c. Equip the rails with safety shoes, as shown in Figure 34. This is especially necessary when you use the ladder on surfaces that could permit the ladder to slip.

d. Under no circumstances use stepladders as substitutes for workstands.

e. When ascending or descending a ladder, face the ladder and hold on to each side rail.

f. When the security of a ladder is endangered by other activities, rope off the area around it, fasten it securely, and assign a man to steady the bottom.

g. When you use a ladder in front of a door, lock it or block off the door and route personnel to another exit.

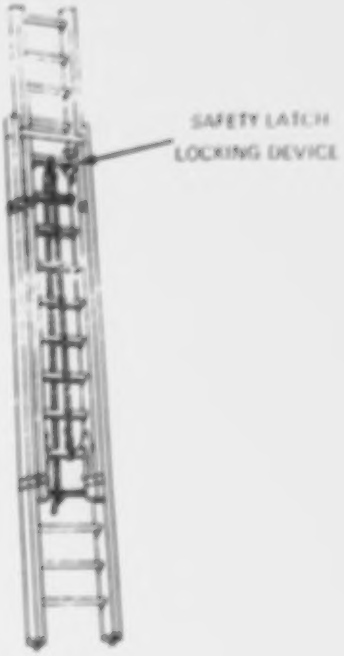


FIGURE 29. Extension Ladder

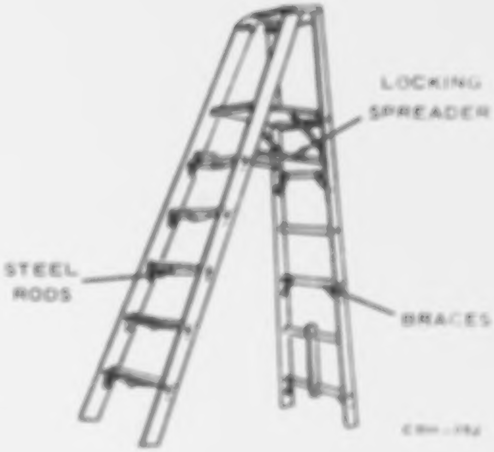


FIGURE 30. Stepladder

h. Never leave a ladder unattended for any length of time while it is erected-take it down and lay it on the ground.

i. When working on a ladder stand no higher than the third rung from the top and do not attempt to reach beyond a normal arm's length.

j. If you need help to do the work, have your helper get another ladder -- don't allow anyone on the ladder with you.

k. Never climb a ladder while using both hands to hold material; at least one hand must be used on the ladder while climbing or descending it.

l. Never place either the top or the bottom of a ladder against unstable material.

It is important for the mason to know safety precautions while performing the duties of his job. Many accidents are prevented by a workman knowing safe and unsafe practices.

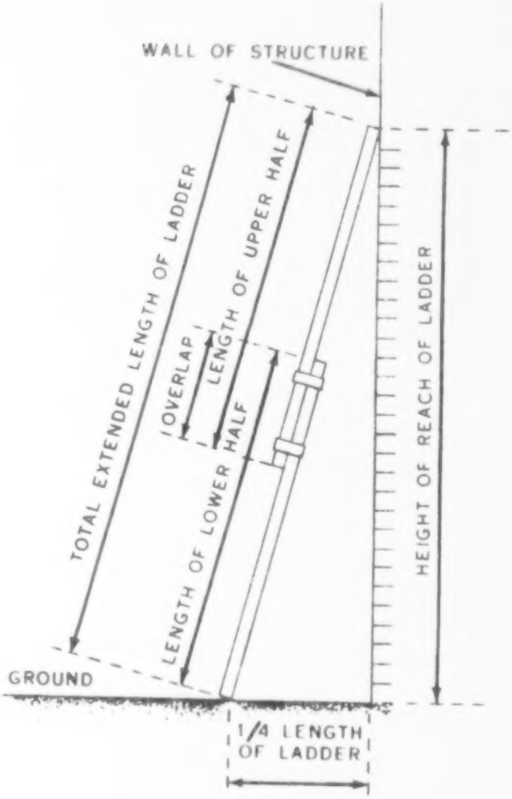

WALL OF STRUCTURE
TOTAL EXTENDED LENGTH OF LADDER
LENGTH OF UPPER HALF
OVERLAP
LENGTH OF LOWER HALF
HEIGHT OF REACH OF LADDER
GROUND
1/4 LENGTH OF LADDER

FIGURE 31. A Properly Placed Ladder

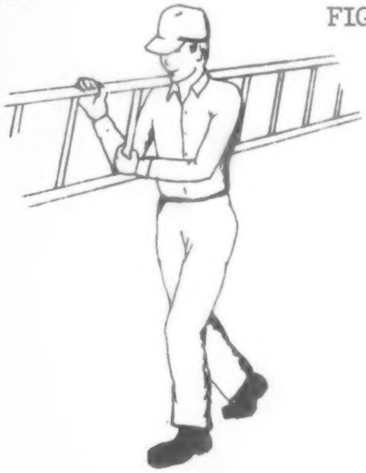


FIGURE 32. Carrying a Ladder

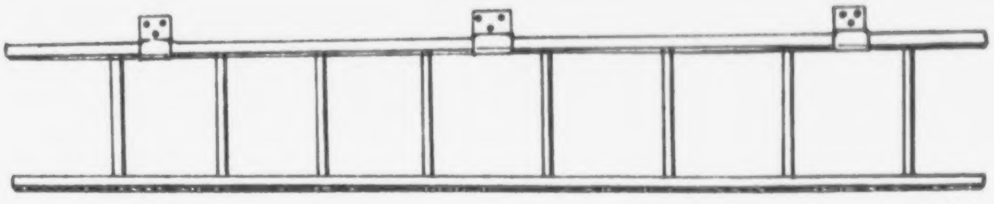


FIGURE 33. Storing a Ladder

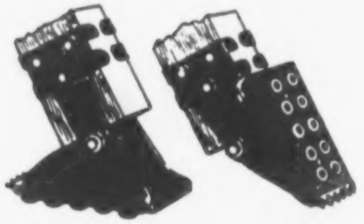


FIGURE 34. Ladder safety shoes

POSSIBLE EFFECTS OF NOT LIFTING CORRECTLY

Learning the correct lifting procedures is essential if you expect to have a long and health military or civilian career. As a mason you will be required to lift many objects of different weights and sizes. If safe lifting procedures are not followed you run a high risk of bodily injury to the extent of being crippled for life. Some of the possible effects of improper lifting are: damage to the spinal column and nerve endings, crushed fingers or feet, or hernias.

CORRECT LIFTING PROCEDURES

AFR 69-8, provides guidance on handling of materials. The physical differences between workers makes it impractical to set a safe weight lifting limit. Overall physical condition, period of constant lifting, lift height, the distance loads are to be carried, frequency of lifting and carrying heavy loads, and the size and shape of the loads are factors to be considered when establishing your own safe weight lifting limit. Before attempting to lift any object, you should first inspect it for size and weight, and then for grease or any other substance that could cause you to lose your grasp or footing and slip. Objects that are too heavy or cumbersome for one person to lift and handle should be lifted by two people. When lifting you should insure that your footing is secure; then grasp the object in such a manner that it can be held even if it should become unbalanced. If at all possible you should begin to lift an object from a squatting position as illustrated in Figure 35 with your back nearly straight and using your legs as the primary lifting force. When available, you should use a mechanical device to lift loads that require excessive exertion. Proper planning when placing materials on the job site will avoid the needless lifting and re-handling of the materials at a later time.

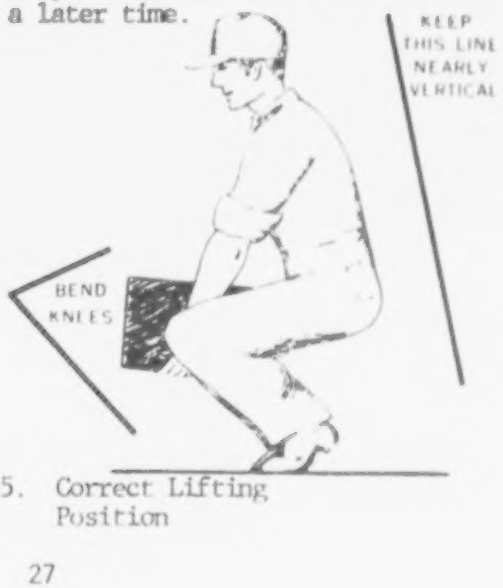
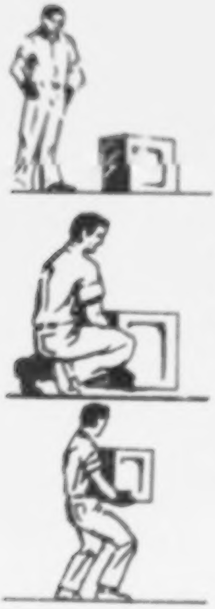

KEEP THIS LINE NEARLY VERTICAL
BEND KNEES

FIGURE 35. Correct Lifting Position



LIFT THIS WAY

1. Check weight and size. A bulky, unbalanced load can cause more strain than a compact heavier one.
2. Plant your feet firmly, well apart, and squat down.
3. Watch out for sharp edges. Get a good grip.
4. Keep your back as straight as you can. Lift slowly (don't jerk) by pushing up with your legs.
5. Don't twist your body with the load. Shift your feet.

FIGURE 36. Lift This Way

Lifting and setting down are the first and last movements performed in handling materials. When done by hand, it is during these movements that most body muscle strains occur. It is important that a mason consider the following basic techniques so as to reduce the possibility of injury as also illustrated in Figure 36.

a. Consider the size, weight and shape of the object to be carried. Do not lift more than you can handle comfortably. If necessary, get help.

b. Set feet solidly with one foot slightly ahead of the other for increased stability. Place the feet far enough apart to give good balance.

c. Get as close to the load as possible. Crouch or squat over the load, bending your legs about 90° at the knees.

d. Keep the back as straight as possible. It need not be vertical, but it should not be arched. Bend at the hips, not the middle of the back.

e. Grip the object firmly. Maintain the grip while lifting and carrying.

f. Straighten the legs to lift the object and at the same time, bring the back to a vertical position.

g. Never carry a load that you cannot see over or around. Make sure the path of travel is clear.

Setting down an object requires just the reverse procedure.

WORK AREA HAZARDS

Shop and work area floors should be kept clean and clear of any objects which could cause personnel to slip or stumble.

All cutting tools should be kept sharp and in good condition at all times. Any defective tool should be immediately repaired or replaced. Be sure to wear protective clothing when working with potentially hazardous tools or equipment.

Make sure that your work area is well ventilated to avoid breathing hazardous fumes or dust. A respirator should be worn if necessary.

Your work area or shop should be adequately lighted to work safely. Good lighting is important to safety in all shops.

Be sure to remove all jewelry before doing a job. Rings, watches, bracelets, and necklaces are a very potential safety hazard when working with any type of tools or equipment.

At no time will horseplay be tolerated in any shop or work area.

Carelessness is the biggest cause of accidents in the Air Force today.

AFR 127-2 describes the USAF Mishap Prevention Program. The importance of hazard reports cannot be overemphasized. This system provides direct contact between the person observing a hazard and responsible officials. It formalizes safety problems so they can be investigated and solved. Difficulties that sometimes occur and that should be avoided in administration of a hazard reporting program are:

a. Failure to follow up. Follow up action will be taken to assure that all corrective actions are completed on a valid report.

b. Failure to publicize the system and make forms available to operators.

c. Failure to evaluate a report on its merits. Whether or not a report is valid, the evaluator must remember that the originator submitted the report in the belief that a hazard existed.

ELECTRICAL HAZARDS AND PRECAUTIONS

The apprentice mason will use a wide variety of tools and equipment which are powered by electricity because of their convenience, speed, and their efficiency. However, because of their source of power, they are hazardous to operate unless you know how to safeguard against the hazards. The main hazards are from fire, improper groundings and cord abuse.

Electrically powered handtools are a potential source of ignition for a fire if used near flammable materials or in explosive atmospheres, unless they are of the explosion proof type. You must be continuously aware of this hazard as you work in different areas that may have an explosive atmosphere due to a concentration of flammables. All electric tools will be equipped with a (polarized) grounding plug and a three-wire cord containing a grounding conductor. When using an electric tool requiring the use of an extension cord it should also have three wires and be equipped with polarized plugs. When plugging in the power tool or extension cord be sure that the receptacle is also grounded. Double insulated tools are self grounding and do not contain the third grounding wire. They should not be altered to have a polarized plug. If a short develops in a tool with a polarized plug or is double insulated and the cord is connected into a grounded receptacle, you will be safe as illustrated in Figure 37. Figure 38 illustrates an electric drill with a three-wire plug and cord. It is also important to protect the cord on your power equipment. The conductors in the cord, the insulation on the cord, and the plugs must be protected to provide for the safe operation of the power tool. Scraping, kinking or stretching, as well as exposure to grease and oil will damage power tool cords or extension cords. The polarized plugs should be heavy duty plugs that clamp to the cord. Double insulated plugs are molded plastic which is molded to the wire to prevent detachment and to safeguard the worker.

The wide use of electric power tools is evidence of their work value; however, they must be used properly because they may cause severe injuries if improperly used. The following is a list of precautions to take while using electrically powered tools:

a. Inspect the power tool, especially the external wiring before you use it. Check for broken plugs, frayed, broken or cracked wiring.

b. Use safety glasses, goggles or face shields where chips or dust could fly or tools could break.

c. Do not wear jewelry when operating electric power equipment.

d. Do not wear loose gloves or loose clothing while using rotating power tools or equipment.

e. Change accessories with the power off and the cord unplugged. If a guard was removed be sure to replace the guard before starting the tool again.

f. Do not jerk the tool cord or extension cords from the receptacle to unplug them, this will in time damage the cord or cause the connections in the plug to become loose.

g. Use rubber mats when any moisture may be present under your footing.

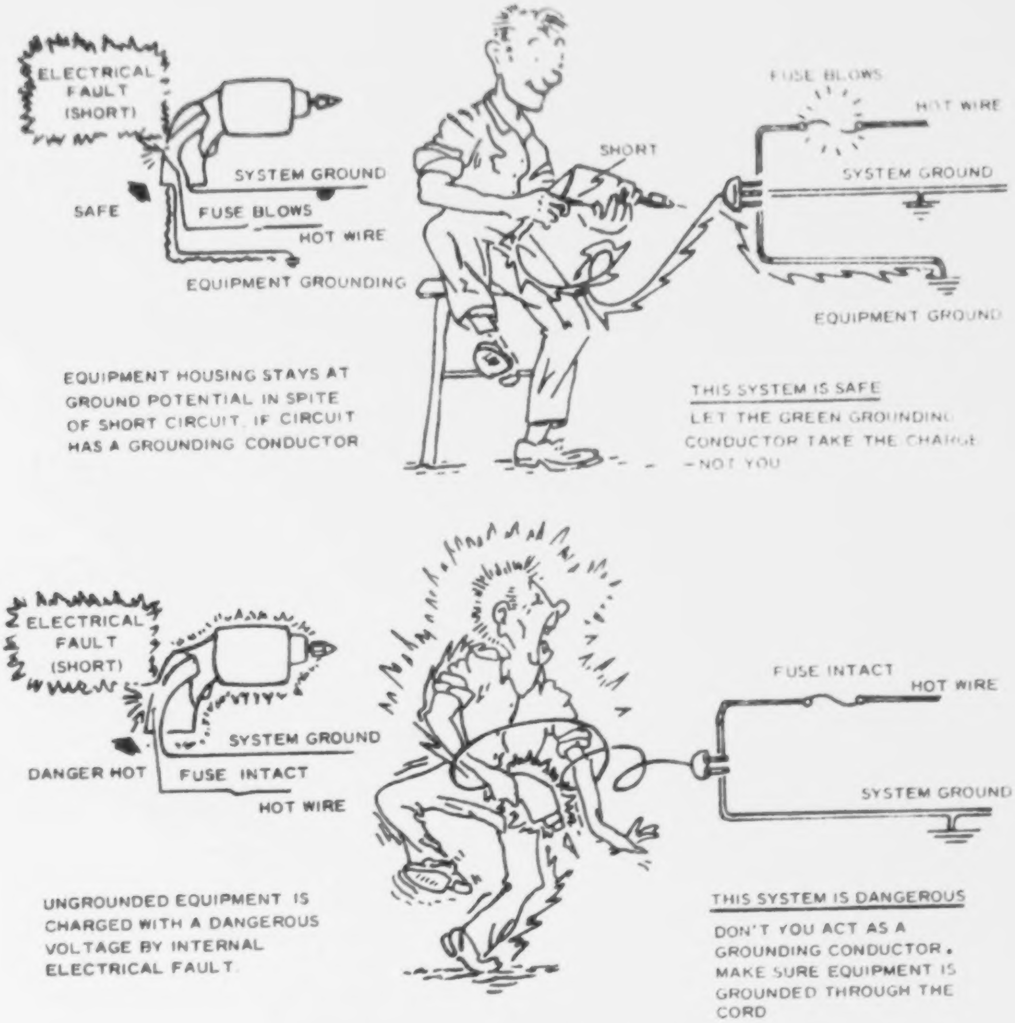

ELECTRICAL FAULT (SHORT)
SAFE
SYSTEM GROUND
FUSE BLOWS
HOT WIRE
EQUIPMENT GROUNDING
SHORT
FUSE BLOWS
HOT WIRE
SYSTEM GROUND
EQUIPMENT GROUND
EQUIPMENT HOUSING STAYS AT GROUND POTENTIAL IN SPITE OF SHORT CIRCUIT, IF CIRCUIT HAS A GROUNDING CONDUCTOR
THIS SYSTEM IS SAFE
LET THE GREEN GROUNDING CONDUCTOR TAKE THE CHARGE —NOT YOU
ELECTRICAL FAULT (SHORT)
DANGER HOT
SYSTEM GROUND
FUSE INTACT
HOT WIRE
FUSE INTACT
HOT WIRE
SYSTEM GROUND
UNGROUNDED EQUIPMENT IS CHARGED WITH A DANGEROUS VOLTAGE BY INTERNAL ELECTRICAL FAULT.
THIS SYSTEM IS DANGEROUS
DON'T YOU ACT AS A GROUNDING CONDUCTOR. MAKE SURE EQUIPMENT IS GROUNDED THROUGH THE CORD

FIGURE 37. Equipment Grounding

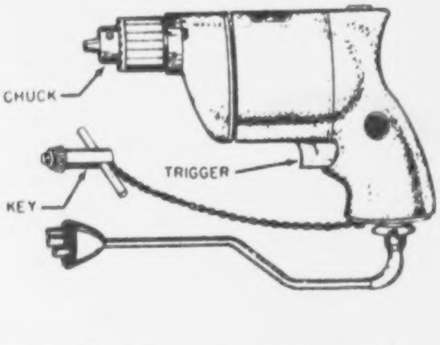

CHUCK
TRIGGER
KEY

FIGURE 38. Electric Drill with Polarized Plug

ACID SAFETY

In the masonry field, it is sometimes necessary to work with various types of acids. Acid is safe to work with as long as you wear the protective devices as described in AFOSH Standard 127-31, Personal Protective Clothing and Equipment. These protective devices consist of protective chemical goggles or full face shields, rubber acid suits, aprons, sleeve's, and gloves, and acid resistant safety shoes or rubber knee, hip or thigh (safety cap) boots, also at certain times respirators.

Since you may be working with acid, a potential safety hazard does exist. There is the possibility of being burned as well as the fumes created from the acid. Burns are injuries to body tissues caused by heat, radiation, electricity, or chemicals. The last of which concerns you in the masonry field, and the effects are many and varied. Burns can cause body disfigurement, loss of body function and the possibility of loss of life. The after effects left from a burn depends upon the type, duration, and intensity of the caustic (burning) agent. Any burn involving more than 20 percent of the body surface endangers life. All burns are serious, but facial burns are extremely dangerous because they are usually accompanied by injury to the eyes and the respiratory tract. When working in a confined area with acid be sure to have adequate ventilation and use a respirator. It is extremely important that the acid be added to the water and not vice versa. This will prevent the acid from splashing up and chancing to burn you.

EMERGENCY TREATMENT FOR ACID SPILLS

Acid spills should be handled with care to avoid damage to property or personal injury. If you should happen to spill some acid, immediately flood the area with water. Do not spray the area in a manner which could cause the acid to spread or splash. Water is a natural diluting agent for acid and will stop the action of the acid. For an acid spill or splash that comes in contact with the skin, flush immediately with a mixture of 20% sodium bicarbonate (baking soda) and water, and get medical attention immediately. If sodium bicarbonate is not available flush with water for 15 minutes and get medical attention immediately. If acid is splashed into the eyes, flush immediately with water for 15 minutes and get medical attention.

MAINTENANCE OF TOOLS AND EQUIPMENT

OBJECTIVE

Working as a member of a team, using instructions and checklists, and exercising safety precautions, perform preoperational inspections, and adjustments or repairs on masonry tools and equipment, with instructor assistance.

Working as a member of a team, using instructions and checklists, and exercising safety precautions, select, clean, sharpen, lubricate or maintain masonry tools and equipment. Limited instructor assistance may be provided.

INTRODUCTION

Tools and equipment are a specialist's best friend, for without them he would be helpless. Regardless of whether you are assigned stateside or overseas, you must have available and be able to choose the proper tools and equipment to do your job. You must also have the knowledge and skill to use them properly. Without this knowledge your time is wasted, the efficiency of civil engineering is reduced, and you may cause injury to yourself or to others and damage to expensive equipment.

INFORMATION

Assignment: (Day 1). Read and study chapter 6, Tools, Equipment and Safety, pages 69-76, in your textbook, Modern Masonry. Using a separate sheet of paper answer questions 1 thru 21 listed on page 78 of your textbook. Do not write in the textbook.

To make this study guide easier to understand, it is divided into two sections.

- TOOLS
- EQUIPMENT

This study guide covers a very small amount of the information that is available on this subject; therefore, it is recommended that you read and study the references that will be on file in your Civil Engineering shop when you arrive at your new Base of assignment.

Few words have as many meanings as the word "tools". Each workman has certain tools which he uses in his work. These tools cover a range from such common things as screwdrivers and hammers to such uncommon things as "sky hooks" and "catheads". In this text, only those tools you will be using in your career field will be listed and discussed since these will be the most important to you.

Volumes have been written on the proper use of handtools but the feeling still persists that they are so simple that no one need bother to point out the right and the wrong ways of using them. This study guide outlines the care, handling, and use of basic handtools for your guidance and information. The following suggestions should help you in your career as a Masonry Specialist.

A mechanic uses the tools in his toolkit almost every day. One of the marks of a good mechanic is the care he gives his tools. He prolongs their life and increases his efficiency and the quality of his work by keeping his toolbox organized.

The checklist of a good mechanic looks like this:

1. Keep tools as clean as possible when using them and be sure to clean them before putting them away.

2. Use each tool only for the purpose intended.

3. Have a special place in the toolbox for each tool.

4. Keep every tool in excellent condition. Check tools regularly and replace all broken tools promptly.

5. Make an inventory of tools after each job to prevent leaving tools on the job.

6. Keep junk and unnecessary tools out of toolboxes.

7. Keep tool boxes securely locked and in a safe place when not in use.

TOOLS

Levels

Levels are used for checking plumb (vertical) and level (horizontal) alignment. They are usually made of wood, aluminum or magnesium. Levels are available in many different sizes to fit specific needs.

The masons level is the most delicate tool that a mason uses. A mason's level (Figure 39) is used for both guiding and testing when bringing work to a horizontal, or vertical position. The level has a long body of wood or metal, usually 4 feet long, which has a built-in glass tube on its side and near the end. Each tube contains a non-freezing liquid with a small air bubble within the tube. The side and end tubes are at right angles to each other. When the bubble of the side tube is centered with the hairline, the level is horizontal; and when you center the bubble of the end tube with the hairline, the level is vertical. By holding the level against a surface to be checked, it can be determined whether the surface is level or plumb. Levels should be hung up when not in use.

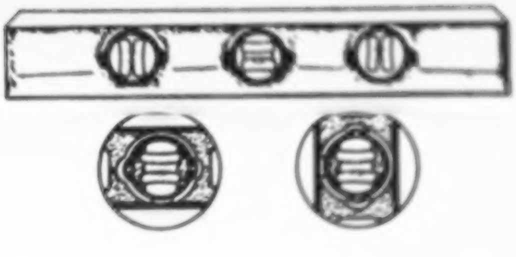


FIGURE 39. Mason's Level

A line level, Figure 47, is about 3 inches in length and normally made of very light material such as thin aluminum. It has a hook at each end to hold it on a line. It is used for leveling a string line when laying foundations, determining ground grade and similar work. A line level has only one bubble tube. To use a line level hang it on a tight line placed at the desired points. Position the level at the midpoint of the line, and adjust the end of the line until the bubble is centered. Before using a level, check the condition of the level, especially the bubble tube and glass cover. Always clean the level after using.

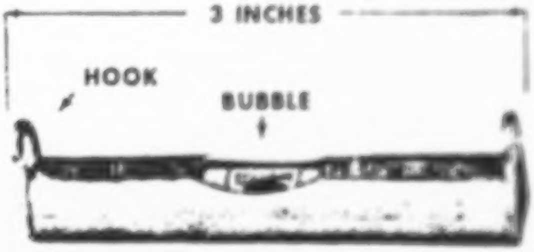


FIGURE 40. Line Level

Measuring Tools

Measuring tools for the mason includes rules and tapes. Measuring must be done accurately because the final outcome of any project is affected by the measurement of each of its parts. Measuring is accomplished by laying out the rule or tape from the starting point and measuring the required distance called for by the plan.

The folding rule, Figure 41, is used for general type measurements particularly where it is necessary for the measure to be rigid, such as measuring across an opening. Folding rules are usually made of wood, although they may be metal. They are available in lengths up to 8 feet. The 6 foot folding rule is a standard tool used by a mason. They are made of sections that are hinged on a concealed joint or rivet, and fold in a zig-zag pattern. They are usually marked in feet, and inches and graduated to 1/16".

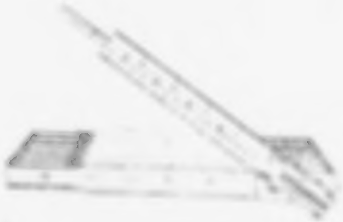


FIGURE 41. Folding Rule

The flexible steel tape is marked off in feet and inches and graduated to 1/16". The flexible steel tape is housed in a metal casing with a spring attachment, which retracts it into the casing. This type of rule is desirable because of its compactness and suitability for taking inside measurements. Figure 42 illustrates one type of flexible steel tape.

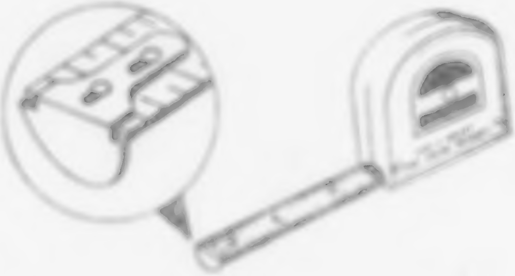


FIGURE 42. Steel Tape

The folding rule should be handled carefully and folded when not in use. The metal hinges should be lightly oiled. Always be careful not to bend a steel tape. If the tape becomes wet, dry with cloth and lightly oil before rewinding.

Hammers

The claw hammer, Figure 43, is used for driving and pulling nails, and for driving items such as wedges, brads, and dowels. The face of the hammer is bell shaped to help keep the outer edges of the face from denting the work. The claw hammer head is made of mild steel. The handle may be wood, steel or fiberglass. These hammers are available in several sizes including 13, 16, and 20 ounce sizes.

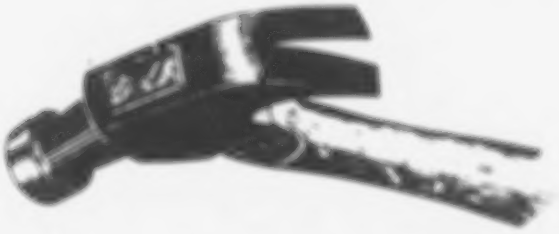


FIGURE 43. Claw Hammer

The sledge hammer, Figure 44, is a general purpose tool for heavy pounding. It is used for such work as driving heavy spikes, drift bolts, metal timber wedges, rock drills, metal stakes and for breaking stones and concrete. Sledges are available in sizes from 2 to 20 pounds and with long or short handles.

FIGURE 44. Sledge Hammer

A brick hammer is used for both pounding and cutting. It has both a cutting blade and a square peen for pounding or breaking and splitting brick or block. The flat head can be used to drive nails, strike chisels and break masonry. The chisel end is used to trim masonry. The brick hammer has a steel head with a steel or wooden handle. Figure 45 shows a brick hammer.

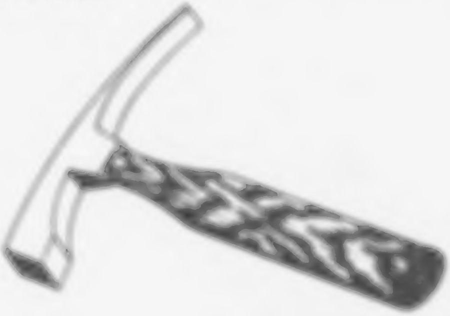


FIGURE 45. Brick Hammer

A tile hammer looks like a brick hammer, but it is much lighter in weight. It weight only 3½ ounces. It has both a cutting blade and a square peen for breaking or cutting tile. It is also used for cutting holes in tile. Figure 46 shows a tile hammer.

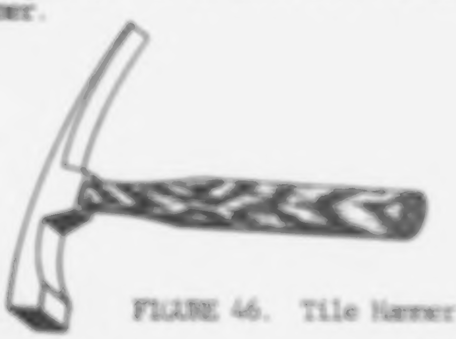


FIGURE 46. Tile Hammer

When using any type of hammer, use only the face for striking an object. Before using a hammer, check the general condition and for a loose or broken handle. After using, remove dirt from the hammer and return it to the storage area.

Chisels

Different types of chisels are made for different kinds of materials and jobs. Chisels are made of a good grade of tool steel, hardened at the point and normally sharpened to a cutting edge at one end. In most uses they are driven by a hammer. They will cut wood, metal, or concrete. Masons use several different types and sizes in their work. The main chisels used by masons are cold chisels, woodworkers chisels, brick sets, and blocking chisels. Best results will be obtained if the proper type of chisel is selected for the job to be done.

Cold chisels are available in many sizes and types. The main types of cold chisels that are used by masons are: the diamond point, round nose, cape, and flat. See Figure 47. A flat chisel is used for cutting sheet metal or chipping concrete. A cape chisel is used for cutting grooves, slots, keyways, or cutting surfaces where a flat chisel is too wide. Use a round nose chisel to cut concave joints and a diamond point chisel to cut V-joints.

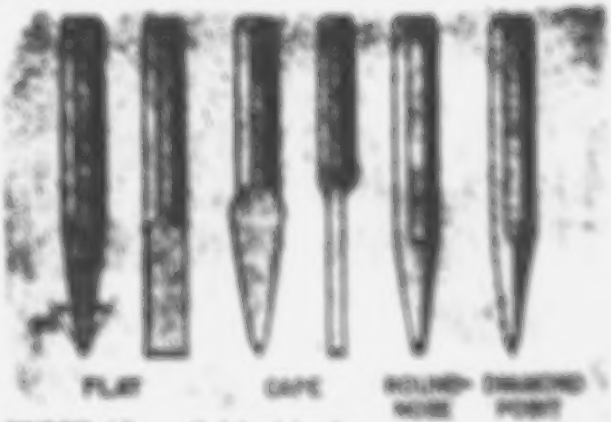


FIGURE 47. Cold chisels

Woodworkers chisels are steel tools fitted with a wooden or plastic handle. They are designed to cut and shape wood. Some are made for hand use only, while others may be driven with a wooden mallet. A commonly used type is shown in Figure 48.

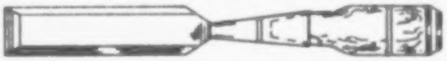


FIGURE 48. Woodworkers Chisel

A brick set, Figure 49, is an all metal type of chisel that is used to cut brick. The cutting edge of the brick set is very blunt. A brick hammer is normally used to strike the brick set; however, a standard heavy-duty hammer may be used.

FIGURE 49. Brick Set

A blocking chisel, Figure 50, is a type of chisel that is used to cut concrete block. It is an all metal chisel that is made in a variety of sizes and shapes.

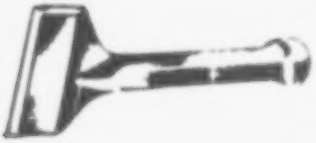


FIGURE 50. Blocking Chisel

Chisels, like all cutting tools, must be sharp to give satisfactory service. Sharpening is usually done on an ordinary coarse grinding wheel. The blows of a hammer will eventually cause the blunt end of a chisel to spread out until it resembles a mushroom. When this occurs, the end should be ground back to its original shape. When storing chisels apply a light coat of oil and protect the cutting edge from nicks or other damage.

Trowels

A trowel is the mason's principle working tool. A trowel is a flat steel tool, that is made in various sizes and shapes. They are used to spread and smooth plaster, mortar, and cement. There are 3 parts to a trowel: the blade, handle, and the mounting. A mason will use a number of special purpose trowels; however, his main trowels are the cement masons trowel and the brick trowel.

A cement trowel, Figure 51, has a flat rectangular blade approximately 4 inches wide and 14 inches long. It is used in concrete work for leveling, smoothing and pushing wet concrete mix into place.

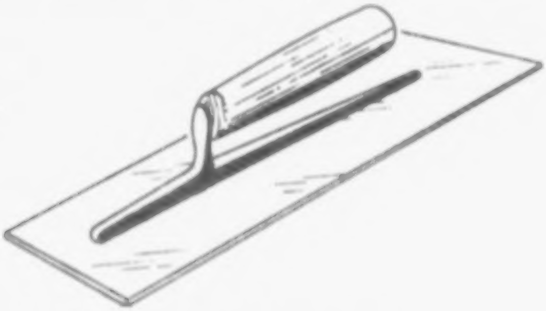


FIGURE 51. Cement Trowel

Brick trowels, Figure 52, are the most important tool in brick masonry. It is used to scoop and spread mortar in laying bricks, stones and similar material. The handle is sometimes used to tap the materials into place.

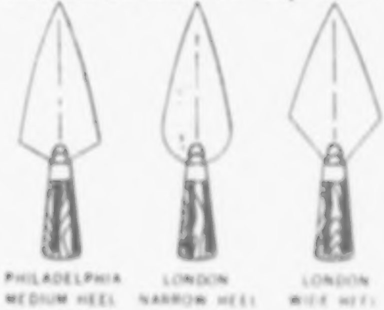


FIGURE 52. Brick Trowels

Trowels should be checked for rust on the blade and for damaged or loose handles. Always clean the trowel after use. If the trowel will not be used again for several days it should be wiped with a clean oily cloth.

Edgers

Edgers are special purpose type trowels that are used to round off and smooth the edge of concrete slabs. This gives the edge a more pleasing appearance and also reduces the chance of the edge breaking off. Edgers are available in many shapes and sizes for both inside and outside corners. An outside corner edge is shown in Figure 53.

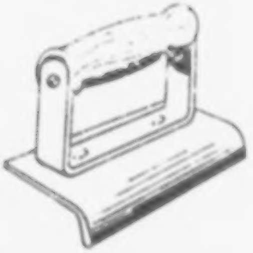


FIGURE 53. Edger

Edgers should be checked for damage and loose handles before use. After use, they should be cleaned and returned to the storage area.

Groovers

A groover, Figure 54, is a tool used to cut joints in fresh concrete. Groovers are also called concrete jointers. They have handles, mounting and blades similar to trowels, except that groovers have a ridge in the center to form a groove. Groovers are usually about 6 inches long, but are available in various sizes. Groovers should be checked for rust, cleanliness and loose handles. Always clean groovers after use.

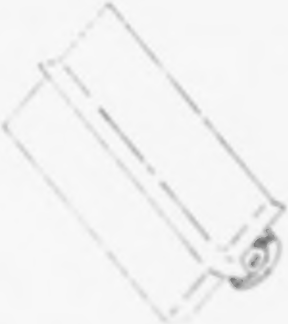


FIGURE 54. Groover

Jointers

Jointers, see Figure 55, are tools used to finish the surface of mortar joints. They are also called joint tools or finishing tools. They are commonly used in brick and block work. Jointers are flat steel tools that are usually forged rods or stamped metal. Vertical jointers are one piece, stamped, all metal tools. Horizontal jointers have longer metal runners and wooden handles. They are used to finish long horizontal joints and are also called sled runners or joint runners.

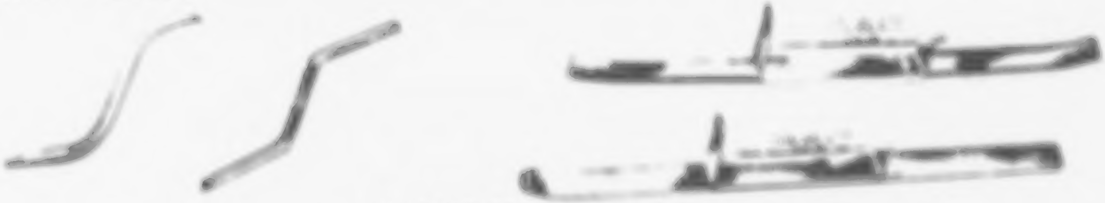


FIGURE 55. Jointers

Check jointers for rust and loose or damaged handles. Clean jointers after use.

Joint Rakers

A joint raker is a tool designed to produce a raked masonry joint. This is done by raking out the masonry in a brick or block joint while the mortar is still green. The 2 main types of joint rakers are the plain joint and the skate wheel. A plain joint raker is similar to a vertical jointer. A skate wheel joint raker looks similar to 2 skate wheels with a handle. Joint rakers should be checked for damage and rust and cleaned after each use. Check the wheels of the skate wheel type for security and freedom of movement.

Darbies

A darby is a long, flat tool used by masons to level the surface of plaster or float the surface of a concrete slab. It is a rectangular piece of wood, aluminum, or magnesium. They are about 3 to 4 inches wide, 30 to 80 inches long, and have a raised handle on one side. A metal darby is shown in Figure 56. Darbies should be checked for condition and cleaned after use.

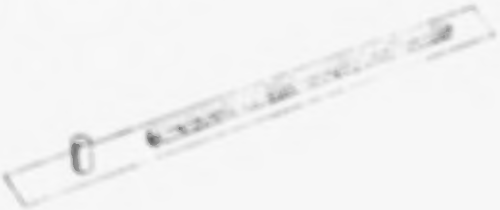


FIGURE 56. Darby

Brick Tongs

Brick tongs are devices made to assist the mason in handling bricks. They consist of a brick holding mechanism and a handle. They can hold about 10 bricks without breaking or chipping them. Brick tongs are adjustable for various sizes of bricks. They should be checked for cleanliness and the adjuster and lock nut checked for proper operation.

Floats

Floats are tools used in finishing concrete or plaster. Hand floats, Figure 57, are made of wood, aluminum, magnesium, cork or molded rubber and range in size from about 10 to 18 inches long. Hand floats have a handle attached and are used on smaller concrete slabs where you can reach the entire area.

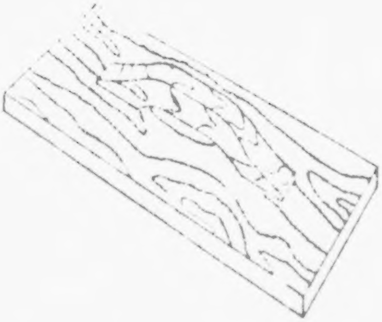


FIGURE 57. Hand Float

A bull float, Figure 58, is a large type float with a long handle for use on large areas. Bull floats may be made of wood or metal. Redwood or cypress is normally used for the wooden type. Metal ones are made of aluminum or magnesium. Metal floats give a smoother surface than wooden ones. Bull floats are usually about 8 inches wide and vary from about 42 to 60 inches long. Some have removable handles that range up to 16 feet long. Bull floats are used to float out large slabs of concrete and are sometimes used in place of a darby.

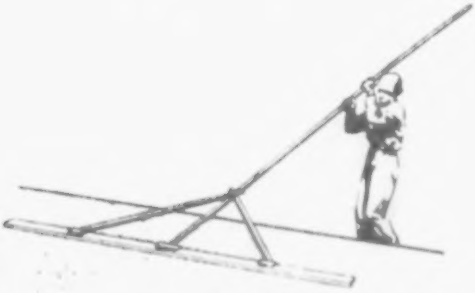


FIGURE 58. Bull Float

Floats should be checked for condition and security of the handle before use. Check the extensions and lock of metal bull floats for condition and operation. Always clean floats after using.

Tamper

There are several types of concrete tampers. As a mason you will mostly use a type of hand tamper. Probably the most common type of hand tamper is one with a flat, perforated face and a large U shaped handle. See Figure 59. This type of concrete tamper is commonly called a jitterbug. Tampers are used to compact the concrete into a dense mass. They are expecially used on flatwork with low-slump concrete that is stiff and hard to work.

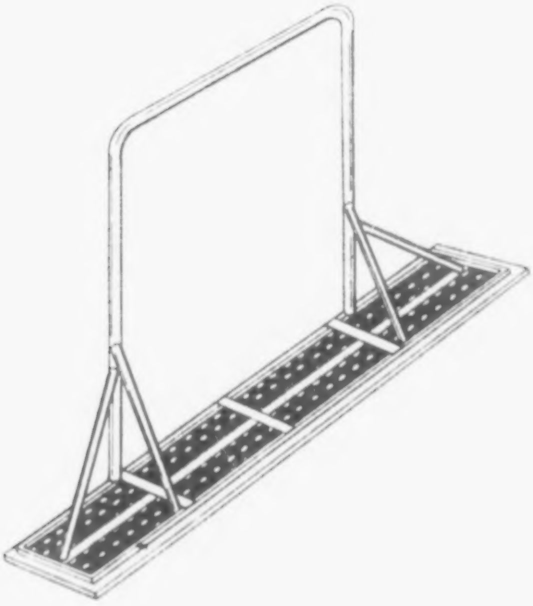


FIGURE 59. Jitterbug

Tampers are checked for loose parts and general overall conditions. Always clean tampers after use.

Line Holders and Lines

A **mason's line** is strong line normally made of nylon or dacron that is used to maintain work level and in alignment. Lines are usually white, yellow or green in color and are available in lengths from 100 feet to 1000 feet. Masons lines are used in brick and block work. Lines are held in place with line holders. The **line holders** used to secure the line at the corners are called corner block. See Figure 60.

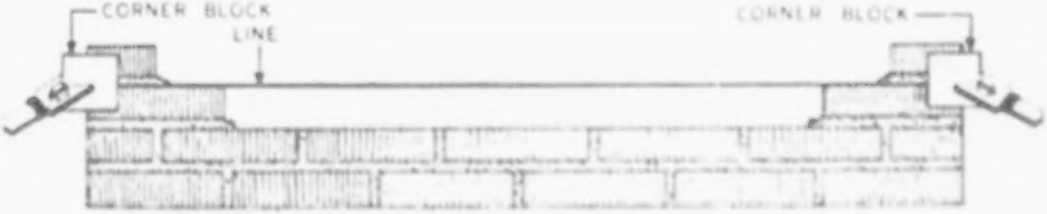


FIGURE 60. Line and Line Holders

When the distance between corners is long, an intermediate line support called a twig is used. The twig may be held in position with a brick bat as shown in Figure 61.

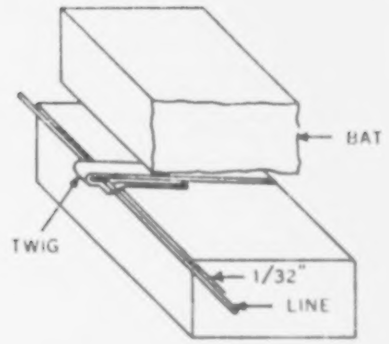


FIGURE 61. Twig

Lines should be checked for fraying. Line holders should be cleaned after using.

Plumb Bob

A plumb bob is made of metal and has a screw-type cap with a hole in the center. A string or plumb line is inserted through the hole and fastened inside. The bottom end has a point in direct line with the hole in the cap, as shown in Figure 62. The string is absolutely perpendicular to the horizontal when the plumb bob is suspended on it. It can be used for the same purpose as the plumb glass on a level; however, the plumb bob is not accurate when used in the wind.

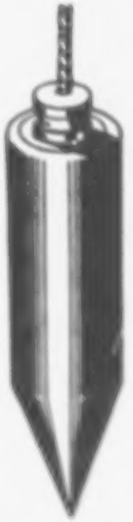


FIGURE 62. Plumb Bob

Saws

There are two types of saws with which you will be working. One type is the handsaw, and the other type is the hacksaw.

Handsaws are used to cut wood for making forms and for cutting plywood backing for tile. There are two types of handsaws, the ripsaw and the crosscut. The ripsaw is used for cutting with the grain of the wood. Ripsaws have 5 to 7 points per inch and have teeth that are shaped and filed to cut like chisels. The crosscut saw is used for cutting across the grain of the wood. Crosscut saws have 8 to 11 points per inch and have teeth that are shaped and filed to cut like knives. See Figure 63.

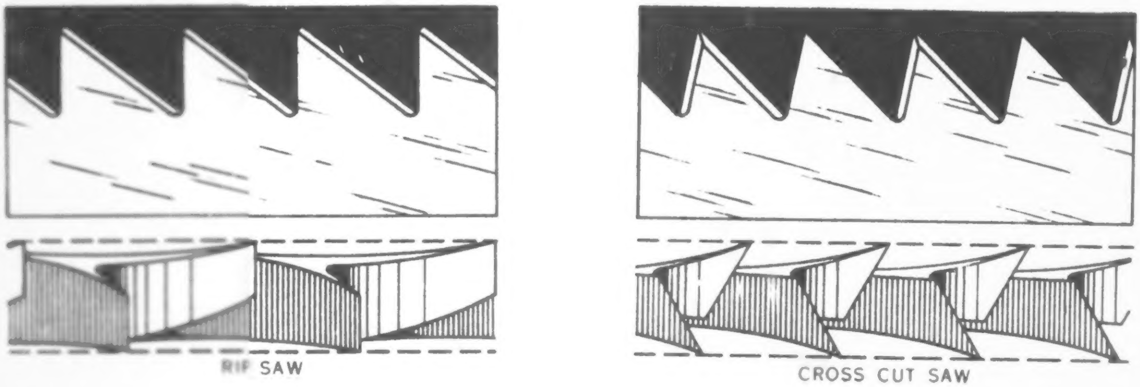
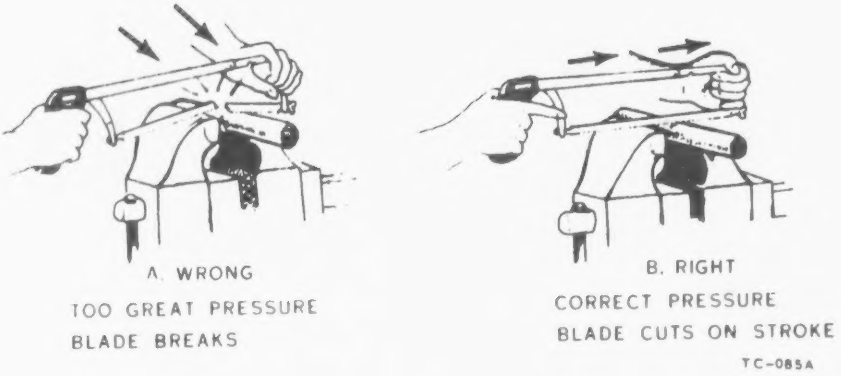


FIGURE 63. The Two Kinds of Handsaws

Hacksaws are made in different shapes and sizes, depending upon the purpose for which they are to be used. Hacksaws may have a rigid frame in which only one length of blade will fit, or they may have adjustable frames that will hold blades from 8 to 16 inches long.

Hacksaw blades are made of high-grade steel, hardened and tempered. They are placed in the frame with the teeth pointing forward. Hacksaw blades may have 14, 18, 24, or 32 teeth per inch. Blades that have few teeth per inch are called coarse blades. Those with a large number of teeth per inch are fine tooth blades. The 18-tooth blade is used for most sawing jobs except thin metal such as sheets or tubing which is sawed with a 24 or 32-tooth blade.

The hacksaw should be held firmly to prevent the blade from "chattering" and twisting. A slight pressure should be applied on the forward (cutting) stroke. It must also be held at such an angle that at least two teeth will be cutting at all times (See Figure 64). The pressure on the cut stroke should be released and the blade drawn straight back. After the first few starting strokes, the length of the strokes should be as long as the hacksaw frame will permit, and no pressure applied on the backstroke. Speed should be held down to 40 to 50 strokes per minute, and never be more than 60 per minute. Just before the cut is finished pressure should be relieved from the hacksaw and the rapidity of strokes decreased. When you need to saw thin sheet metal, clamp it in a vise between two pieces of wood.


A. WRONG
TOO GREAT PRESSURE
BLADE BREAKS

B. RIGHT
CORRECT PRESSURE
BLADE CUTS ON STROKE

FIGURE 64. Correct Use of Hacksaw

Saws should be kept sharp and in good working condition. Check the handle for security and tighten if necessary. The blade should be lightly oiled and stored in a dry place. If rust appears on the blade, remove with fine crocus cloth and re-oil.

Screwdrivers

The common screwdriver has a flat blade, the faces of the blade being almost parallel at the point.

Screwdrivers are usually identified by size according to the combined length of the shank and blade (see Figure 65). Measure the screwdriver from the base of the handle to the tip of the blade. This gives the screwdriver size. Common sizes are 3", 4", 5", 6", 8", 10", and 12".

When using a screwdriver, pressure should be exerted straight down on the handle as shown in Figure 66. When selecting a screwdriver for use, select the largest blade that will fit the screw slot.

Too much emphasis cannot be placed on selecting a screwdriver that fits the screw slot. Figure 67 will aid you in selecting the correct size screwdriver. A screwdriver of the correct size for the screw slot will prevent marking of the blade tip or breaking or bending the tip and reduce the force required to keep the screwdriver in the slot in addition to preventing damage to the screw slot. Remember, there is a properly sized screwdriver for every job.

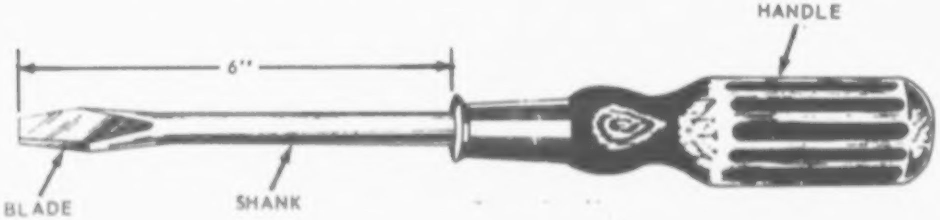


FIGURE 65. Six-Inch Common Screwdriver

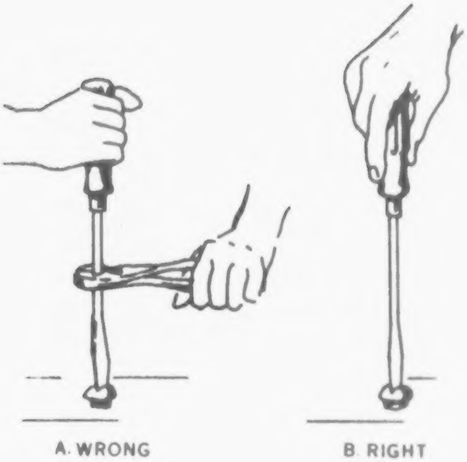

A. WRONG
B. RIGHT

FIGURE 66. Exert Pressure Downward

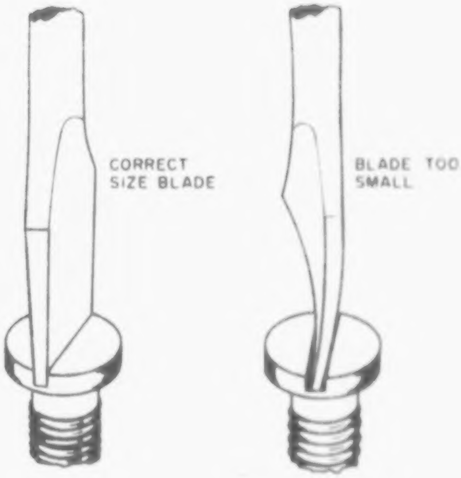

CORRECT SIZE BLADE
BLADE TOO SMALL

FIGURE 67. Blade Size

Another type of screwdriver that you will need to use to adjust equipment is the cross point.

The cross point screwdriver has a blade that forms a cross. There are two kinds of cross point screwdrivers, the Phillips and the Reed and Prince. The Phillips has a blade that tapers to a blunt point. The Reed and Prince has a blade that tapers to a sharp point.

Figure 68 shows the two types of cross point screwdrivers.

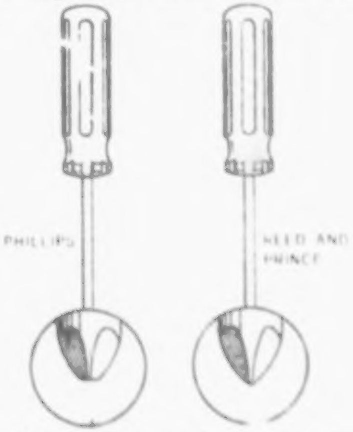

PHILLIPS
REED AND PRINCE

FIGURE 68. Cross-point screwdrivers

Screwdrivers should be kept cleaned and in working condition. The blade of the screwdriver should be ground so that the tip is square. The tip should be thinned on each side and the sides of the tip ground alike in shape and angle.

Repair of a screwdriver handle is difficult. Usually handles will be replaced, but rough handles can be smoothed with a wood rasp and sandpaper.

Files

Files are tools that are used for cutting and smoothing or removing small amounts of metal. Files are available in many shapes and sizes. Files are one-piece metal tools and consist of the following parts: tang, heel, face, edge, and point. See Figure 69.

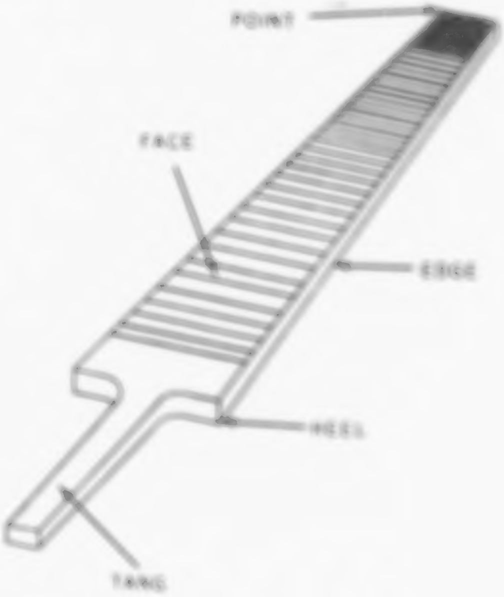


FIGURE 69. Parts of a File

Files are made with single-cut or double-cut teeth. Single-cut files have only one set of teeth in parallel rows. Double-cut files have two sets of teeth cut at an angle to each other, forming diamond-shaped teeth. These diamond-shaped teeth cut faster than single-cut files. See Figure 70.

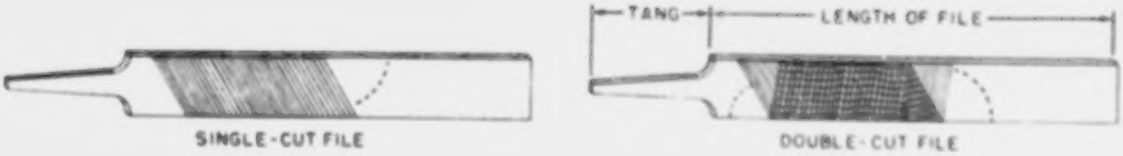

TANG
LENGTH OF FILE
SINGLE-CUT FILE
DOUBLE-CUT FILE

FIGURE 70. Types of Files

The cutting teeth of a file are usually on the face and edge. There are some files however, that do not have teeth on their edge.

The names of files depend upon their shape, size and type of cut. Some cross-section views of files are shown in Figure 71.

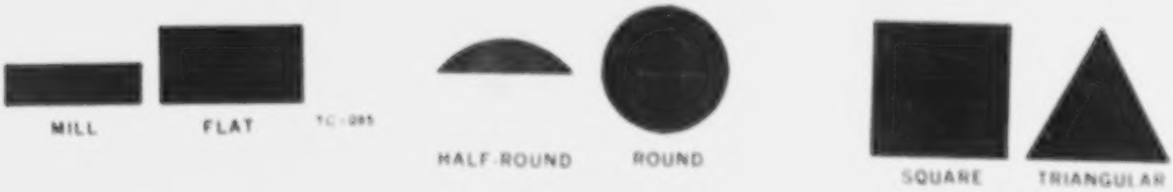

MILL
FLAT
TC-085
HALF-ROUND
ROUND
SQUARE
TRIANGULAR

FIGURE 71. File Shapes

There are many sizes of files available for use. The size of a file is the length from the point to the heel. See Figure 72.

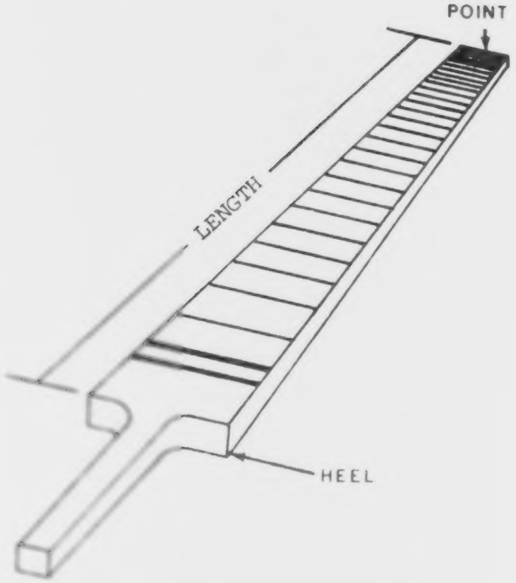


FIGURE 72. File Size

If a file is not cutting properly, it should be cleaned with a file card, pick or soft metal cleaning pin, and a brush. The soft metal cleaning pin, a small pointed wire instrument often furnished with a file card, is for cleaning out the individual cuts in the file that are clogged too tightly with metal to clean with the file card. When cleaning a file lay it flat on the bench and draw the file card brush back and forth across it parallel with the cuts. Finish by brushing the file lengthwise. Be sure to always use a handle with any type of file. When filing use a light even pressure and stroke across the material. Using excessive pressure may cause personal injury and will cause clogging and stripping of the teeth. Figure 73 shows a file card and proper method of use.

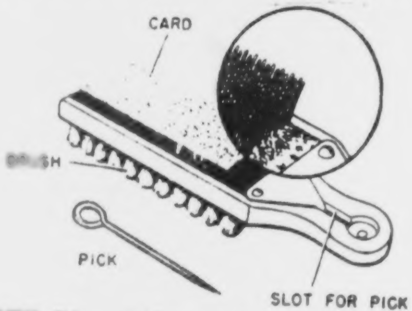


FIGURE 73. File Cleaning

Wrenches

Solid nonadjustable wrenches with openings in each end are called open end wrenches. They are used to loosen or tighten the size nut stamped on the end of the wrench.

The size of the openings between the jaws determines the size of the wrench (see Figure 74). This means the distance across the flats and not the bolt diameter.

As you look at the open end wrenches notice that the head and openings are at a 15-degree angle to the shank. This offset makes it easier to work in close quarters.

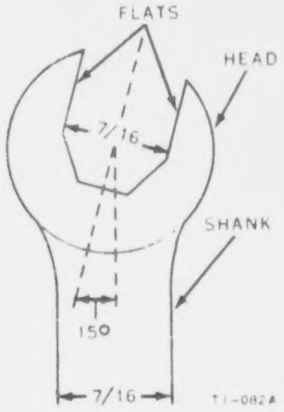


FIGURE 74. 7/16" Open End Wrench

An elementary trick is that of "flopping" the wrench after every stroke -- turning it so the other face is down and the angle of the head is reversed to fit the next two flats of the hex nut. (See Figure 75). This makes it much easier to loosen or tighten a nut. Be sure the wrench fits the nut. A wrench that is too large will round off the nut. Always pull on the wrench, never push it.

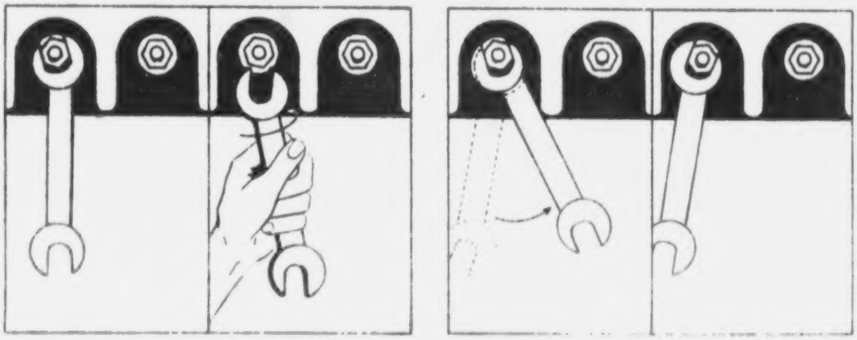


FIGURE 75. Use of Open End Wrench

The adjustable jaw wrench is similar to the open end wrench, except that one jaw is movable enabling a single wrench to be used on several sizes of nuts or bolts (see Figure 76). The size of the wrench is determined by the length of the handle. Always remember to close the jaws tightly against the nut or bolt before starting work. If this is not done, the nut or bolt will be damaged by the jaws.

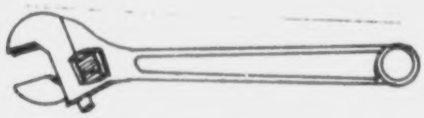


FIGURE 76. Adjustable Jaw Wrench

Wrenches should be cleaned after use. Coat moving parts of wrenches with a light coat of oil. Store wrenches in the tool room or designated area. Do not use broken tools, they can be a safety hazard.

Pliers

The word PLIERS is a plural name for a single tool. Pliers are made in many styles and sizes and are used to perform many different operations. There is a definite field of usefulness for pliers, but they are emphatically not a substitute for a wrench. Pliers are used for holding and gripping small articles in situations where it may be inconvenient or impossible to use hands.

Slip-joint pliers, also called combination pliers (Figure 77) are pliers with straight, serrated (grooved) jaws, and the screw or pivot with which jaws are fastened together may be moved to either of two positions, in order to grasp small - or large - sized objects better. They are a general purpose holding tool that is most often used for gripping and bending wire.

FIGURE 77. Slip-joint Pliers

To spread the jaws of slip-joint pliers, first spread the end of the handles apart as far as possible. The slip-joint, or pivot, will now move to the open position. To close, again spread the handles as far as possible, then push the joint back into the closed position.

Diagonal cutting pliers (Figure 78) are used for cutting small, light material, such as wire, nails and cotter pins in areas which are inaccessible to the larger cutting tools. Also, since they are designed for cutting only, larger objects can be cut than with the slip-joint pliers.

As the cutting edges are diagonally offset approximately 15 degrees, diagonal pliers are adapted to cutting small objects flush with a surface. The inner jaw surface is a diagonal straight cutting edge. Diagonal pliers should never be used to hold objects because they exert a greater shearing force than other types of pliers of a similar size. The sizes of the diagonal cutting pliers are designated by the overall length of the pliers.

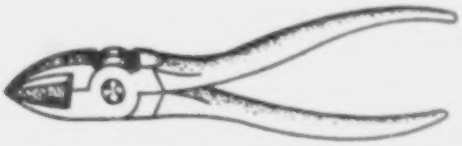


FIGURE 78. Diagonal Cutting Pliers

The long nose pliers shown in Figure 79 are used for holding small objects. They also have cutting jaws for cutting small, light material. Long nose pliers make it possible to bend or form wire and light metal into a variety of shapes or to work in close spaces.

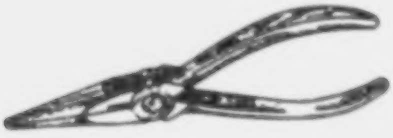


FIGURE 79. Long Nose Pliers

Tile nipper pliers are a type of end cutting pliers that are used to trim ceramic tile. Tile nippers may have replaceable jaws or be of one piece construction. For continual heavy duty work, nippers can be obtained with carbide jaw tips.

Tile nippers are used to "nibble" away small bits of ceramic tile to allow the tile to fit smoothly around pipes and other items. A typical pair of tile nipper pliers is shown in Figure 80.

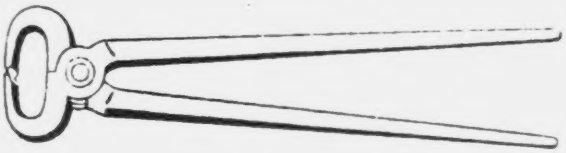


FIGURE 80. Tile Nipper Pliers

Pliers should be cleaned after use by washing off dirt and drying with a cloth. Lightly oil the moving parts and store in designated area.

Allen Wrenches

Allen wrenches are merely six sided bars bent into the shape of an "L". They are used to turn internal wrenching bolts and screws (see Figure 81).

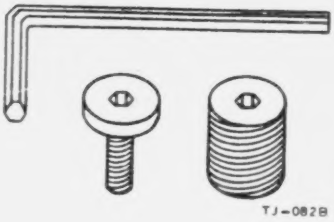


FIGURE 81. Allen Wrench Applications

Remove dirt and grease from Allen wrenches after use. Dry with clean cloth. Remove rust with crocus cloth. Apply light coat of oil to prevent rust.

Cutters

In the masonry field you will have to cut certain types of metals and wire. Some of the tools you will use are the metal cutting shears, also called snips, and the bolt cutters.

Shears are used for cutting light sheet metal up to 1/16 inch in thickness and screen wire. Shears are available in many different sizes. Straight blade shears are used for making straight cuts. Shears with curved blades are convenient for making curved cuts. See Figure 82.

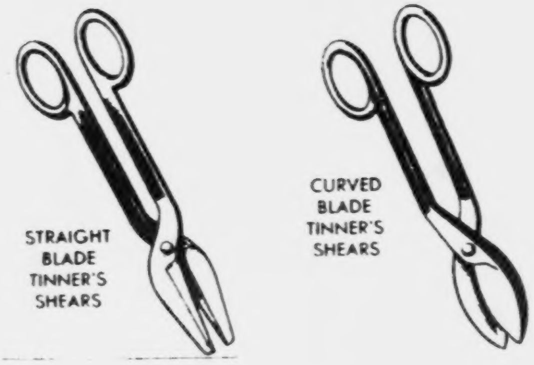


FIGURE 82. Metal Cutting Shears

Bolt cutters (Figure 83) are giant shears with very short blades and long handles. The handles are hinged at one end. The cutters are at the ends of extensions which are jointed in such a way that the inside joint is forced outwards when the handles are closed, thus forcing the cutting edges together with great force. Bolt cutters are made in lengths of 18 to 36 inches. The larger ones will cut mild steel bolts and rods up to 1/2 inch. The material to be cut should be placed as far back in the jaws as possible.

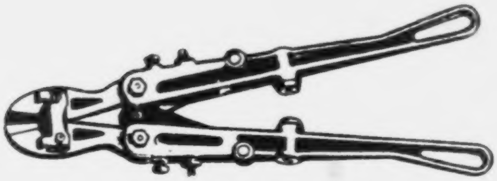


FIGURE 83. Bolt Cutters

Never attempt to cut spring wire or other tempered metal with bolt cutters. This will cause the jaws to be sprung or nicked. The hinges should be kept well oiled at all times.

When using bolt cutters make sure your fingers are clear of the jaws and hinges. Take care that the bolt head or piece of rod cut off does not fly and injure you or someone else. If the cutters are brought together rapidly, sometimes a bolt-head or piece of rod being cut off will fly some distance.

Bolt cutters are fairly heavy, so make sure that they are stored in a safe place where they will not fall and injure someone.

Shears and bolt cutters should be cleaned after use. They must be kept sharpened and the moving joints lightly oiled.

Framing Square

In construction work, especially in house framing and building layout, the framing square is an invaluable tool. The framing square is used in checking the squareness of building materials and the squaring or angling of a mark placed on the building material. Much could be written on the framing square because of its many uses. The mason will use the framing square also when setting forms.

The framing square is also called a rafter square, a steel square, or a carpenter's square. They are available in steel, aluminum or alloy.

Figure 84 illustrates the framing square and its principle parts. The body of the square is the wider and longer member; the tongue is the shorter and narrower member. The face is the side visible both on the body and the tongue when the square is held with the tongue in the right hand and the body pointing to the left. The face is also identified as the side with the manufacturer's name on it.

The square most generally used is the one with an 18-inch tongue and 24-inch body.

The framing square is a versatile tool and can be used for many tasks. As you progress in this course, you will become familiar with the framing square and will have an opportunity to study its various uses in more detail.

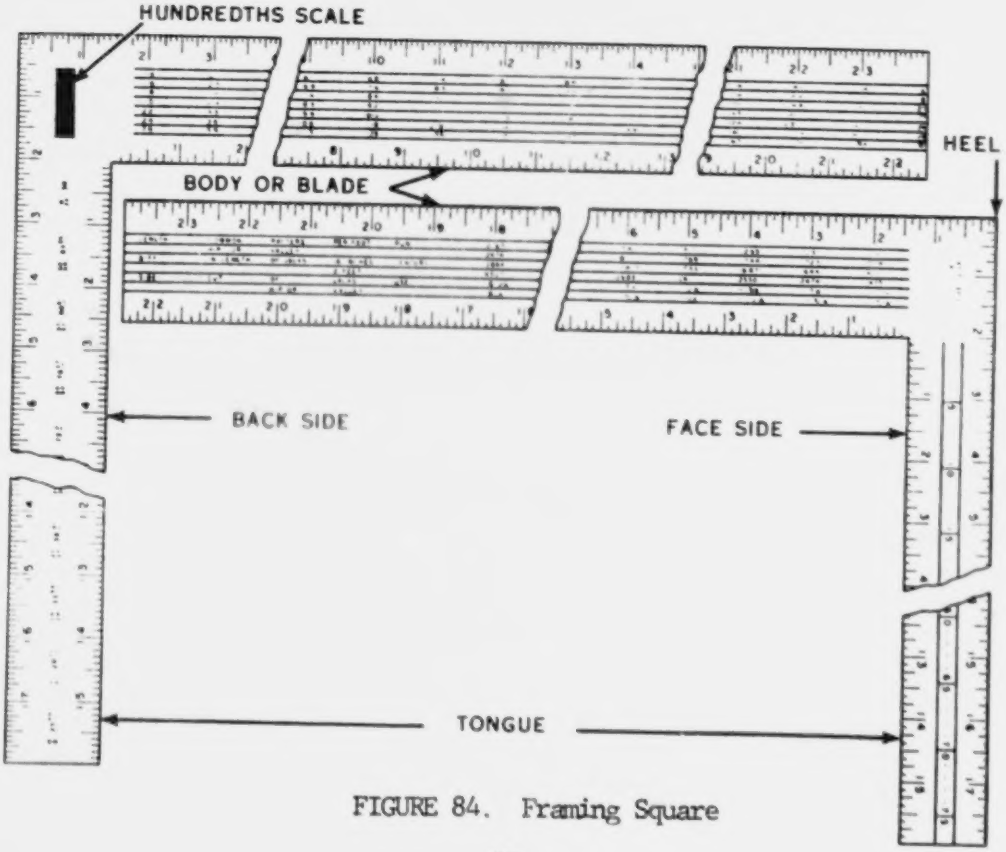


FIGURE 84. Framing Square

When not in use, lay the square on a flat surface only. Clean squares after use by wiping off dirt and moisture with a cloth. Apply a light coat of oil to prevent rust. Check squares for rust and warping.

EQUIPMENT

Concrete Mixer

Although much of the concrete we use is bought locally, and delivered by ready-mix concrete trucks, there are many cases where mix is not available or is impractical. In these cases concrete will be mixed on the job. Mechanical concrete mixers are best suited for mixing at the job site. There are many types of concrete mixers. Some are stationary but more are mounted on trailer wheels. Concrete mixers are available in many sizes ranging from 1/2 cubic foot up to as much as 7 cubic yards.

Concrete mixers are large drums with fins or blades inside. See Figure 85. The drum rotates and the blades stir the contents. They are mounted to permit tilting for loading and unloading. The drums are rotated by an electric or gasoline engine.

When operating a concrete mixer you should be familiar with the manufacturer's recommendations for use and maximum load and comply with them.

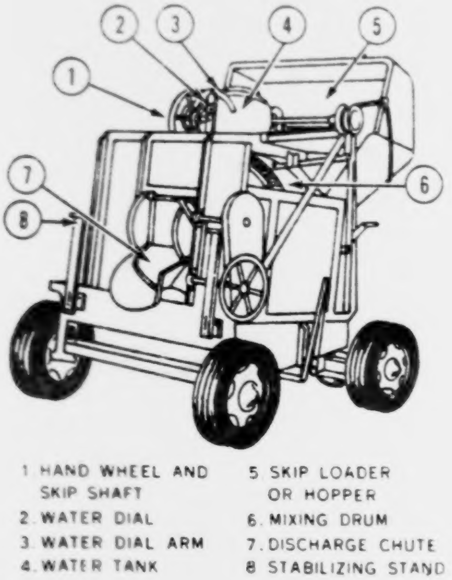

1
2
3
4
5
6
7
8
1 HAND WHEEL AND SKIP SHAFT
2 WATER DIAL
3 WATER DIAL ARM
4 WATER TANK
5 SKIP LOADER OR HOPPER
6 MIXING DRUM
7 DISCHARGE CHUTE
8 STABILIZING STAND

FIGURE 85. Concrete Mixer

Clean the mixer daily when in use and after each use, if used less than a day. Wash the mixer with a water hose. Use wooden paddles to clean the inside of the drum. Replace the drum blades if badly worn, or concrete has set in them. The drum can be cleaned by filling 1/2 full of aggregate and operating for 5 minutes. Dump the aggregate and flush with water.

Concrete Saw

A concrete saw is a power tool designed for sawing concrete. The purpose of sawing concrete may be to provide expansion joints, control cracking, or to shape concrete. Concrete saws are available in many sizes and types ranging from large wheel mounted units to small portable saws. A size commonly used by the mason is a portable type similar in size and design to a chain saw. It is equipped with a small gasoline engine and uses either the abrasive discs or diamond tip blades.

Safety precautions must always be observed when operating a concrete saw. Always wear goggles when operating a saw and if working in a confined area a breathing mask is required. Removing jewelry, holding saw with both hands, and maintaining steady footing are other safety requirements.

Before operating a saw, check for security of all parts, cleanliness, general condition, and quantity of fuel and oil. Most small gasoline engine concrete saws require cleaning of the air filter about every 1 to 2 hours of operation. After using the saw always clean it before returning it to the storage area.

Mortar Mixer

A mortar mixer is a mechanical machine used for mixing mortar. They are used by the block and brick layer to prepare mortar and by the plasterer to mix plaster. The mortar or plaster mixer is similar to a concrete mixer; however, they are usually smaller. Mixers may be powered by a gasoline engine or an electric motor. They are made in many sizes. A typical size mixer, see Figure 86, mixes about 4 cubic feet at a time. Most mixers have rotating paddles enclosed in a drum-shaped container. The paddles of the mixers are made of steel with a leading edge and an extension made of hard rubber which can be replaced when worn. The purpose of the rubber blades is to keep the drum clean. The engine and gears are enclosed and the mixing drum is completely covered by a safety guard. When mixing has been completed, the drum can be tilted and the mortar emptied into a wheelbarrow. Do not open the guard when the machine is running.

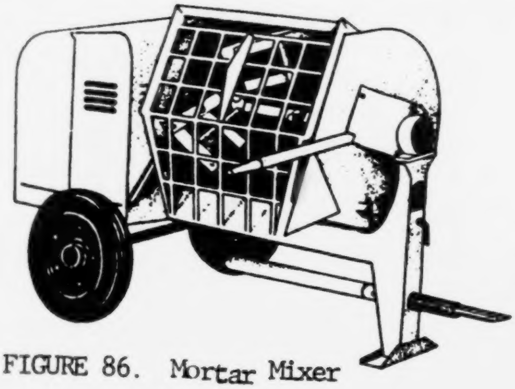


FIGURE 86. Mortar Mixer

Read the manufacturer's instructions and follow them. Clean the machine after each use and at the end of each day. Wash the bucket with a garden hose. Mortar should never be allowed to harden in the mixer.

Tile Saw

The masonry saw is used to cut tile, block, stone, and brick to the exact size required. A typical electric motor driven masonry saw is shown in Figure 87. Some of the main components of this saw are the frame, water pan, electric motor, belts, blade, guards, coolant pump, and control switch. There are a variety of masonry blades that are available for this saw. They range in size from about 6 to 10 inches in diameter, are about 1/8 inch thick. The blades are tipped with hard material such as carbide or industrial diamonds.

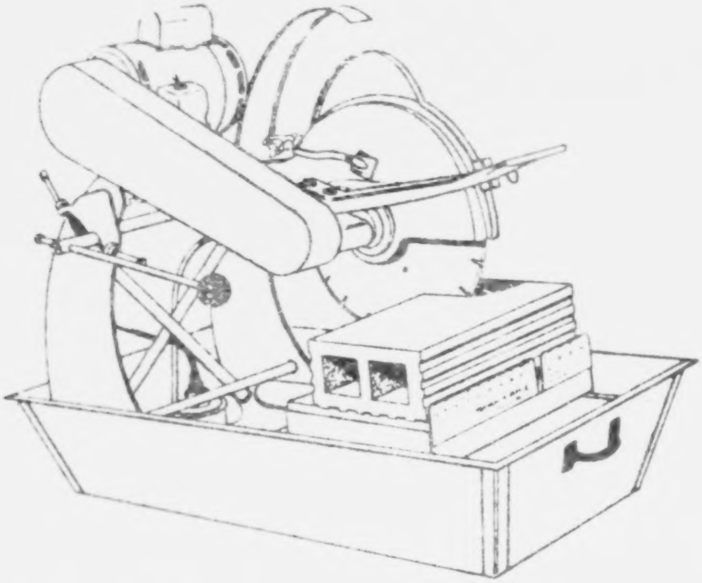


FIGURE 87. Masonry Saw

If possible, order masonry material in the sizes required as masonry blades are expensive and it is time consuming to cut a large amount of material. However, you will need to use the masonry saw for special applications and when the correct size material is not available. When masonry must be cut, the masonry saw provides a faster and more accurate method than using a hammer and chisel.

Before operating the masonry saw, check all components for security of mounting and the belt and blade assembly for free operation. The pan should be checked for water. The saw is a dangerous item to operate and the operator should always wear goggles or a face shield when using the saw.

To operate the saw, plug in the power cord, turn the switch to ON, and turn the water supply to ON. Move the material slowly and smoothly through the blade. After using turn the switches to OFF and clean the machine. Since there are many types, manufacturers, and sizes of masonry saws, always follow the manufacturer's instructions for operating the saw.

Electric Saws

Masons are required to cut lumber for forms. The use of an electric saw makes this job easier and saves time.

Power woodworking saws range in size from small shop jigsaws to the huge bandsaws used in sawmills to saw the largest trees into lumber. Of all the types of mechanical saws, the members of the circular saw family are the most widely used. A circular saw has a circular blade mounted on, and spun by, a shaft called an arbor. Many modern saws have a motor-on-shaft drive, meaning that the arbor and the motor shaft are the same machine part.

Like a common handsaw, a circular saw blade can be a crosscut saw, usually called a cutoff saw, or it can be a ripsaw. The teeth on these blades are similar to those on the corresponding handsaws, and they cut on the same principle. A third type of circular saw blade is called a combination, or miter saw blade, and it can be used for either light crosscutting or ripping.

BENCH SAWS. A tilt-arbor bench saw is shown in Figure 88. It is called a tilt arbor because, when you tilt the blade for cutting bevels, you tilt the arbor only and the table, or bench, remains level. In earlier types of bench saws, the blade and arbor were in a fixed position and the table was tilted. A tilted table is dangerous in many ways, especially when heavy stock must be pushed across it, so most modern bench saws are of the tilt-arbor type.

For ordinary ripping or cutting off, the distance the saw blade should extend above the table top is 1/8 inch plus the thickness of the piece to be sawed. The vertical position of the saw blade is controlled by the saw raising handwheel shown in Figure 88. The angle of the saw blade is controlled by the tilt handwheel. You must keep the guard in place except when its removal is absolutely unavoidable.

RADIAL ARMSAW. A radial armsaw is illustrated in Figure 89. The motor and arbor pivot in a yoke arrangement and can be swung in any direction. A yoke clamp handle holds the motor in the desired position. The yoke slides back and forth along the carriage on the arm. The carriage can also be swung in any direction. These arrangements make the radial armsaw adaptable to almost any conceivable type of saw cutting.

To crosscut, or to make related machine operations across the grain of the stock, the material is held ridigly on the table and the blade is pulled through it. For ripping, the motor is rotated in the yoke so that the blade, or the line of cut, is parallel to the front edge of the table. The material is moved along the table and is fed into the blade for ripping. Here, the motor position is stationary and the material is moved, much the same as on a bench saw.

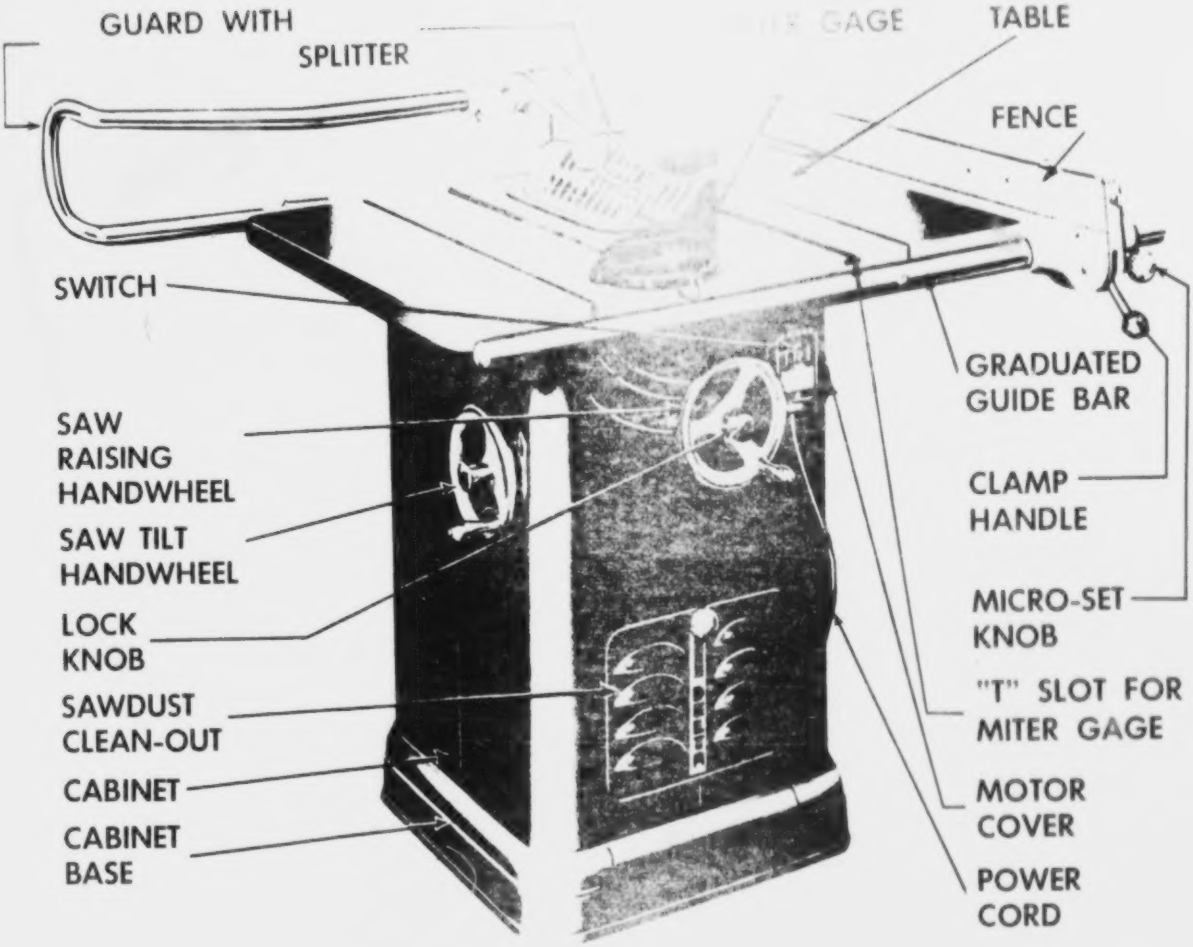

GUARD WITH SPLITTER
MITER GAGE
TABLE
FENCE
SWITCH
GRADUATED GUIDE BAR
SAW RAISING HANDWHEEL
CLAMP HANDLE
SAW TILT HANDWHEEL
MICRO-SET KNOB
LOCK KNOB
"T" SLOT FOR MITER GAGE
SAWDUST CLEAN-OUT
CABINET
MOTOR COVER
CABINET BASE
POWER CORD

FIGURE 88. Tilt-Arbor Bench Saw

PORTABLE ELECTRIC CIRCULAR SAWS. The portable electric circular saw, Figure 90, consists of a sturdy motor in a metal housing which has a pistol-grip handle and a circular saw blade. The on-off switch is built into the handle. Sizes of these saws range [illegible] 1 1/2 horsepower.

(1) This saw has an adjustable [illegible] to allow tilting the base of the saw for sawing in various angles. The bottom plate is flat and wide enough to support the saw on the lumber being cut. The circular saw blade is covered by a spring guard that opens when sawing, to allow the cutting edge to operate. The guard is designed to snap back automatically when the cut is finished.

BEST COPY AVAILABLE

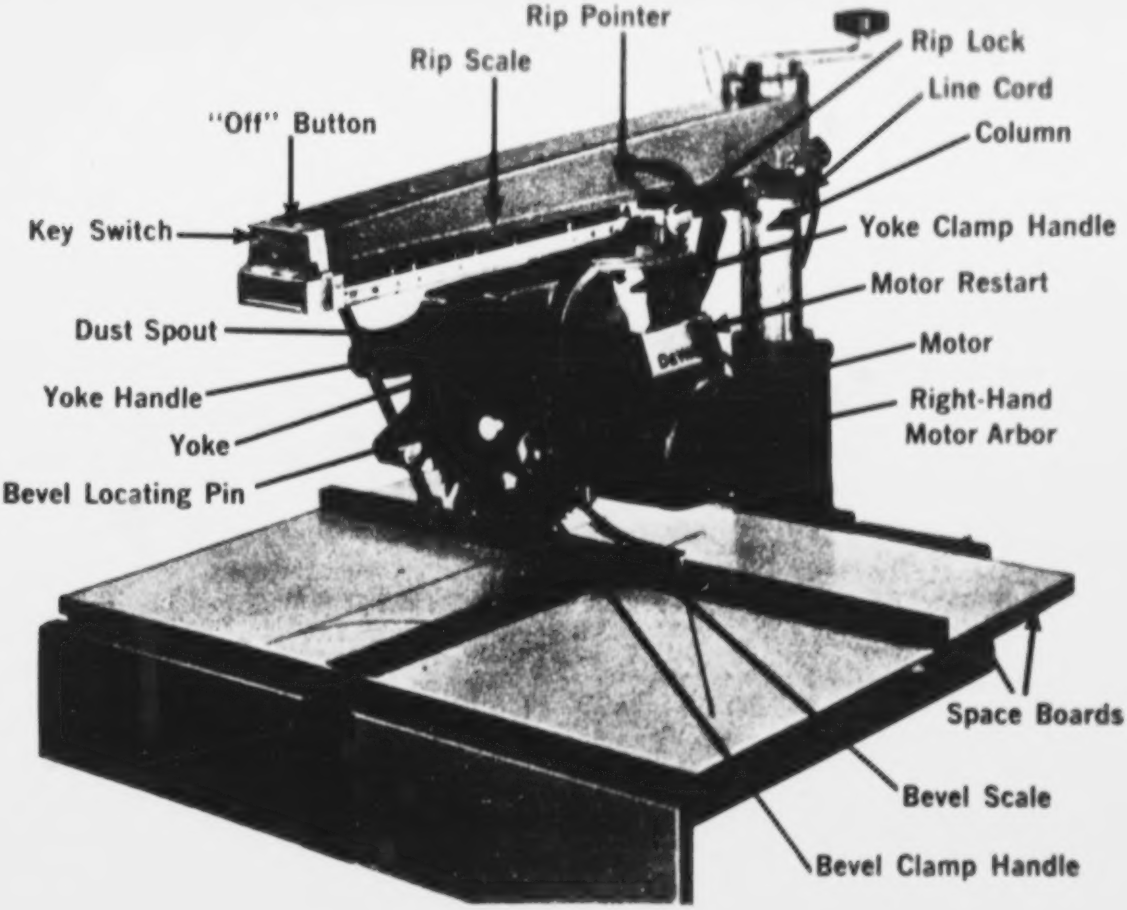

Rip Pointer
Rip Scale
Rip Lock
Line Cord
Column
"Off" Button
Key Switch
Yoke Clamp Handle
Motor Restart
Dust Spout
Motor
Yoke Handle
Right-Hand Motor Arbor
Yoke
Bevel Locating Pin
Space Boards
Bevel Scale
Bevel Clamp Handle

FIGURE 89. Radial Armsaw

(2) Saw blades for the electric circular saw range from 4 to 14 inches in diameter, depending on the size of the motor. The blades are available with teeth specifically designed for crosscutting or ripping. There is also a blade with a combination of cutting and raker teeth, for ripping, crosscutting, or mitering.

In using the electric circular saw, set the saw's guide to the correct angle and depth of cut. Be sure the material to be sawed is steadied by its own weight or is secured firmly by clamping or wedging. Press the switch trigger in the handle to start the saw. The saw blade must be revolving at full speed before it contacts the material's cutting surface. When cutting (See Figure 91) apply firm pressure but do not force the saw. To change saw blades, first disconnect the power. Remove the blade by taking off the saw clamp-screw and flange, using the wrench provided for this purpose (See Figure 90). Install the new blade making certain the teeth are in the proper cutting direction (pointing upward toward front of saw) and tighten the flange and clamp-screw with the wrench.

Note: The circular blade can be put on backwards which makes the saw a hazard to operate. Most blades have instructions "this side out" stamped on them.

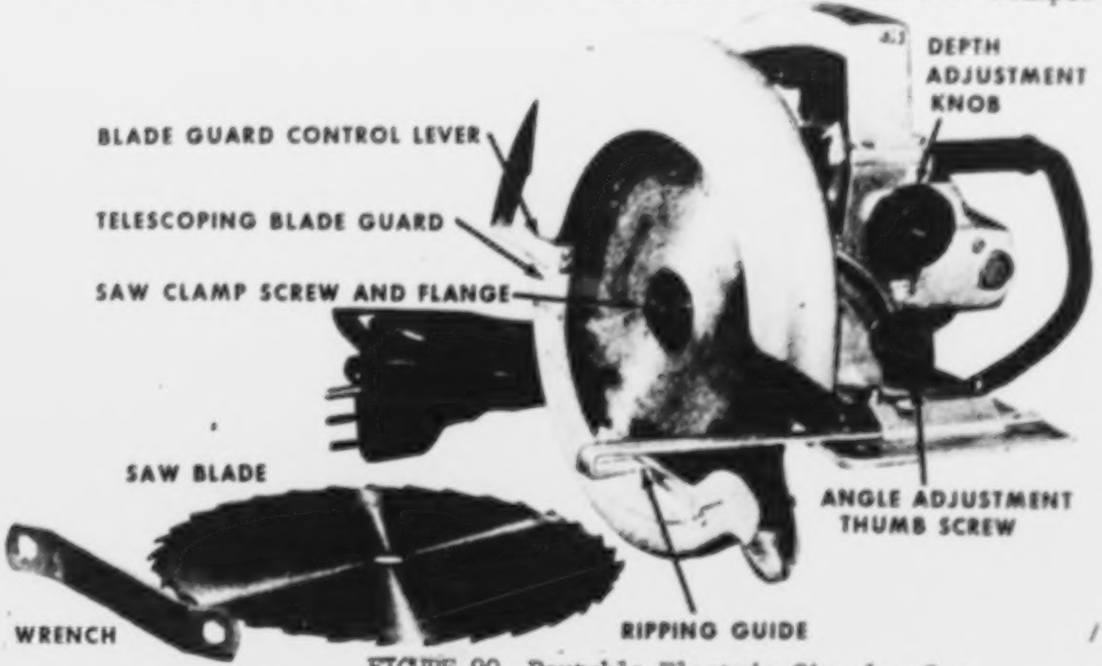
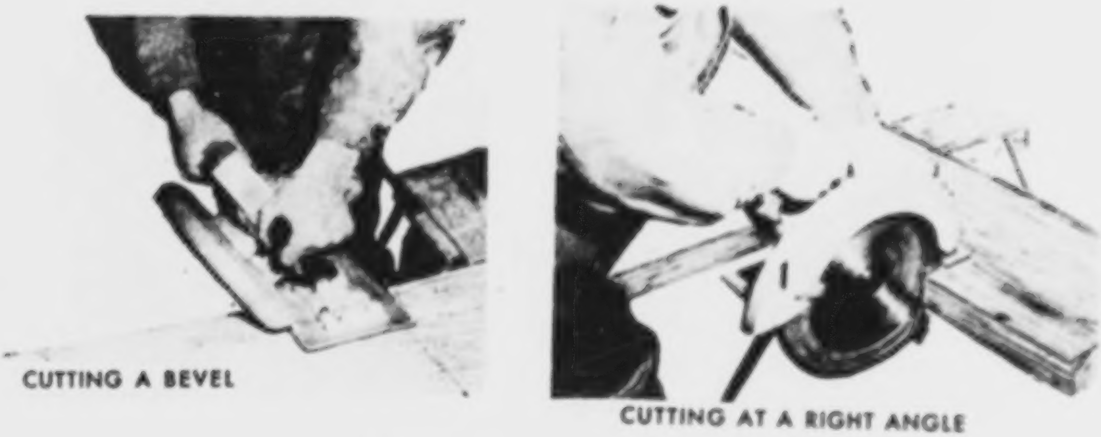

DEPTH ADJUSTMENT KNOB
BLADE GUARD CONTROL LEVER
TELESCOPING BLADE GUARD
SAW CLAMP SCREW AND FLANGE
SAW BLADE
ANGLE ADJUSTMENT THUMB SCREW
WRENCH
RIPPING GUIDE

FIGURE 90. Portable Electric Circular Saw


CUTTING A BEVEL

CUTTING AT A RIGHT ANGLE

FIGURE 91. Using the Portable Electric Circular Saw

Portable Electric Hammer

The portable electric hammer is used as a drill and as a hammer. It can be used for beveling, calking, and beading; for drilling in masonry, driving nails, digging in clay, breaking light concrete, and performing other similar jobs.

The portable electric hammer (see Figure 92) consists of a metal housing on a spade type or pistol-grip handle. Inside the housing, a strong spring moves a steel piston back and forth in a pounding manner when the power switch is on. The housing's muzzle is designed to hold a variety of bits such as chisels, diggers, and tampers. The forward stroke of the piston activates the bit. A removable tool-retaining spring clip is located at the housing muzzle.

In using the electric hammer, the bit to be used is inserted into the muzzle until it snaps into place and is held securely. The handle of the electric hammer is held firmly with one hand while the other hand steadies and guides the tool as shown in Figure 93. Most of the operations performed with this hammer require the use of safety goggles to protect the eyes. It is a good policy, when using the cutter type accessory with this tool, to ease up slightly on the pressure when nearing the end of the cut. This reduces the intensity of the hammer blows, to soften the impact of any material that might detach itself and fly from the work.

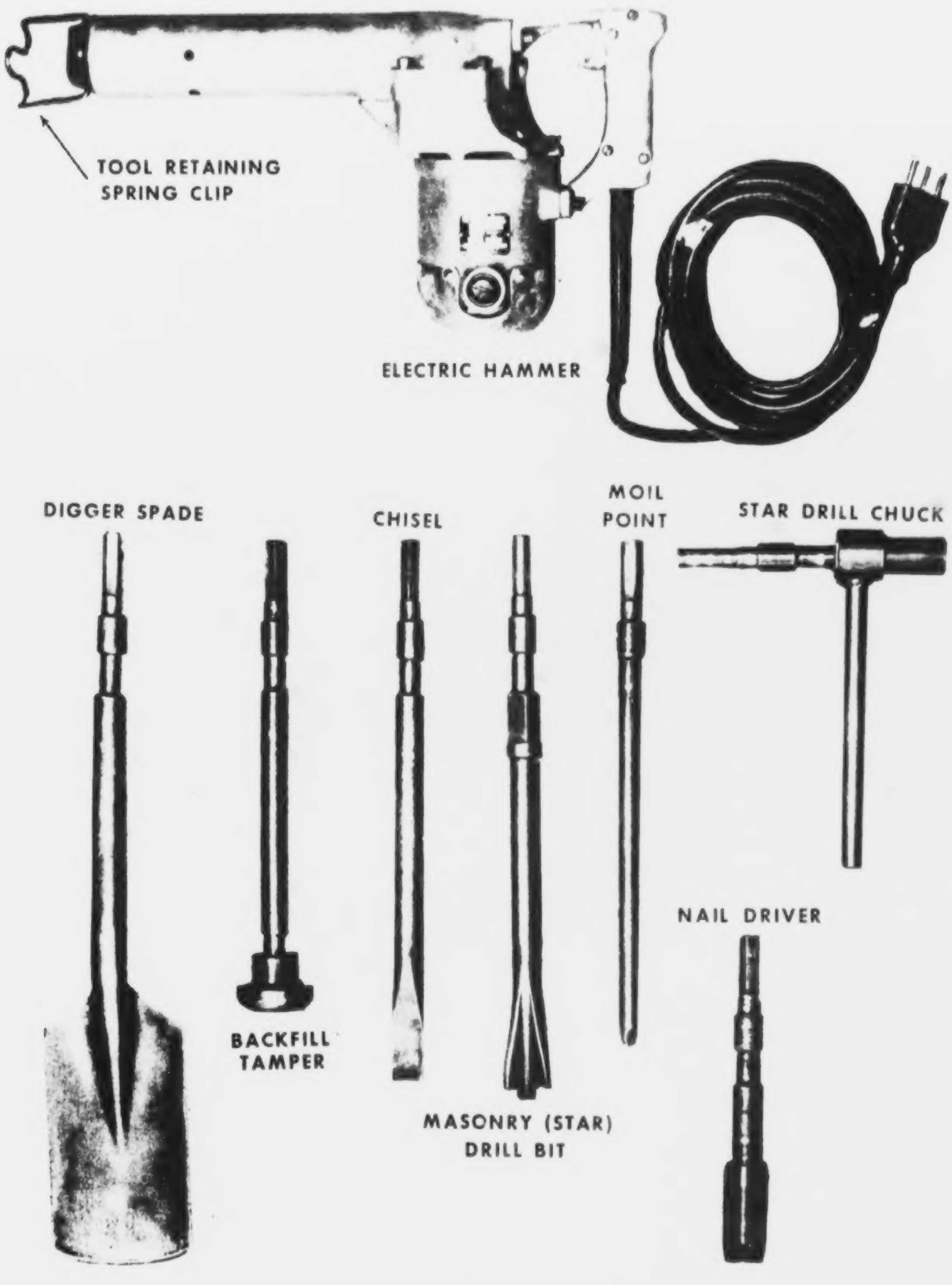

TOOL RETAINING SPRING CLIP
ELECTRIC HAMMER
DIGGER SPADE
CHISEL
MOIL POINT
STAR DRILL CHUCK
BACKFILL TAMPER
MASONRY (STAR) DRILL BIT
NAIL DRIVER

FIGURE 92. Portable Electric Hammer and Attachments

FIGURE 93. Using the Portable Electric Hammer

Pavement Breaker

The pavement breaker of "jackhammer", as it is sometimes called, is a common pneumatic tool. It is operated with air supplied by the air compressor. The pavement breaker is used for breaking up concrete that must be removed.

Air Compressor

The air compressor is a piece of equipment that supplies air for operating pneumatic tools, such as the pneumatic tamper and the pavement breaker. The type of air compressor is usually wheel mounted and uses a small gasoline engine to drive the compressor. However, some types may use an electric motor.

Always use caution when working with compressed air type equipment.

Electric Drill

The electric drill is used by the mason for drilling holes in concrete blocks, brick, and tile. The mason also uses the electric drill to install anchor bolts or to put up bathroom fixtures. Figure 94 shows an electric drill.

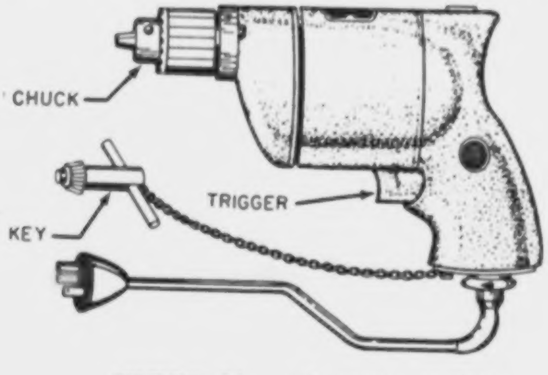


FIGURE 94. Electric Drill

The common sizes of drills that a mason will use are the 1/4 inch, 3/8 inch, and 1/2 inch. These numbers refer to the size of drill bit that the drill can hold. The larger size drills are normally used for drilling concrete. To drill concrete use a carbide or diamond tip drill and a heavy duty, low speed drill.

SAFETY

The safe use of tools and equipment is an important part of your job. Poor maintenance and the improper use of common hand and power tools result in many accidents which can be avoided if proper safety procedures are followed. One of the most abused rules, in the use of tools, is failure to use the right tools for the right job. If you are not familiar with the equipment or procedures you are to perform, check AFOSH Standard 127-66, General Industrial Operations or other AFOSH Standards, before proceeding. Also contact your supervisor and have him show you the proper use and procedure to be followed in any operation that you are not familiar with.

SUMMARY

There are many types of hand and measuring tools with which you will perform your job. Some of these tools are the screwdriber, hammer, wrenches, chisels, and pliers. Each tool has its own particular application and must be used for that purpose only.

Modern equipment would be useless if accurate measurement and adjustment could not be made. Several types of measuring tools are used for this purpose. In your career field, frequent use of tools such as rules, tapes and wrenches will be necessary.

Tools and equipment must be clean and properly adjusted. Care must be taken to use the proper type and size tool for a particular job. Tools should be stored properly so they will not be damaged while in storage.

Remember, regardless of the type of job to be done, you must select and correctly use the proper tools and equipment in order to do your work quickly, accurately, and efficiently.

QUESTIONS

1. Which of the tools that a mason uses is considered to be the most delicate?

____

2. Which type of level is light weight and usually about 3 inches in length?

____

3. What is the name of the zigzag type of measuring device? ______________

4. Which type of hammer is designed for pulling nails? ______________

5. Which type of cold chisel is used to cut V-joints? ______________

6. The type of chisel that is used to cut concrete is called a ______________.

7. A London Narrow Heel is a type of ______________________________.

8. The tool used to finish long horizontal brick joints are called __________ runners or ________________ runners.

9. Concrete is compacted into a dense mass by use of a ________________.

10. A mason's line is usually made of ______________ or ______________.

11. To cut lumber with the grain of the wood you should use a ____________.

12. A hacksaw blade should be installed with the teeth pointing____________.

13. ________________ wrenches are used to turn internal wrenching bolts.

14. How is the inside of the concrete mixer cleaned?________________

____

15. Which types of blades are used for sawing concrete?______________

____

16. A masonry saw can be used to cut block, stone, ______________ and

_____________________________.

REFERENCES

1. AFOSH 127-66, General Industrial Operations

2. Textbook: Modern Masonry, Goodheart-Wilcox, Inc Copyright 1977

3. CDC 55233, Volume I, Apprentice Mason

PROJECT PLANNING

OBJECTIVE

Given architectural drawings, identify masonry materials used, dimensions, and location of given components by completing at least 70% of the exercises.

INTRODUCTION

A drawing is a picture, a sketch, or a diagram. It can be a simple outline of a project to be done, or it can be a very complicated drawing from which blueprints are made.

Planning is a very important part of every Air Force activity. All of the projects that you as a masonry specialist will be working on will cost a lot of money. Therefore, you can see that good planning is very important. Some day you will be called on to help with the planning. There will be a time when you will be a member of a conference where plans are made and specifications are written for both big and small masonry projects. Also as a member of a Base Civil Engineer Emergency Force (Prime BEEF) team, you may be called on to plan a repair or construction project on your own. At times like these you can see how important good planning can be. Also, you can see why you need to know how to plan. First write the specifications and then draw the blueprints. Yours would not be expected to be the finished product but with a knowledge of planning, type of information included in specifications, and the correct use of symbols and lines on drawings, you could convey to others your ideas and thoughts. Abbreviations used in a drawing are a shortened form of a word or a phrase.

INFORMATION

Assignment for Day 2: Read and study Chapter 12, Blueprint Reading, pages 187-208 in your textbook Modern Masonry and answer the questions at the end of the chapter.

ARCHITECTURAL DRAWINGS

Architectural drawings are divided into two general classes: primary drawings, which consist of design sketches and drawings for display purposes; and working drawings (blueprints), which consist of views (flat surface line drawings) giving detailed information necessary for actual construction of the building. The construction of a building is described by a set of drawings which give a thorough graphic description of each part of the operation. Usually, a set of plans begins by showing the boundaries, contours, and outstanding features of the construction site. Succeeding drawings give instructions for erecting the foundation and superstructure; installation of lighting, heating and plumbing; and details of construction required to complete the building.

SUMMARY

Success in the Masonry Specialist career field is determined, to a certain extent, by your ability to make and carry out plans.

Good planning incorporates the knowledge and experience of others. From planning comes the blueprints with which you work. To successfully complete any project to which you are assigned, it is essential that you be able to interpret the lines, symbols, and abbreviations used on blueprints and drawings.

QUESTIONS

1. What are thre other names for construction drawings?

2. What kind of lines is used to represent the visible features of a building?

3. If a part is hidden, it is represented with a ____________ line symbol.

4. A circular object usually has a __________ line drawn through the center.

5. What kind of line is used to show the length of a wall?

6. What is the purpose of symbols and abbreviations?

7. If a plan is drawn at ¼" = 1' -0" scale, how long would a 40'-0" wall be on a drawing?

8. Identify the seven drawings which usually compose a set of working drawings for a building.

    1. ____
    2. ____
    3. ____
    4. ____
    5. ____
    6. ____
    7. ____

CONCRETE MIXTURES

OBJECTIVE

Working as a member of a team, and using materials provided, measure mix, and perform field tests for consistency of three concrete mixtures. Instructor assistance may be provided for most parts of the task.

INTRODUCTION

Concrete is one of the most useful building materials ever developed by man. It is strong, long-lasting, fairly cheap to use, and easy to handle. Huge dams, bridges, skyscrapers, roads, and runways are built of concrete.

Each of us has an idea of what cement is. We also have an idea of what concrete is. But do we know what the properties of cement are? Also, do we know how to mix quality concrete to obtain a finished product of the highest quality that will present the least amount of maintenance.

INFORMATION

Assignment for Day 2 read and study Chapter 7, Concrete Fundamentals, pages 79 thru 84 in textbook, Modern Masonry. Also study the following additional information.

CEMENT STORAGE AND SHIPMENT

Package and Shipping of Cement

Cement is shipped either in sacks or in bulk. It is usually packed in cloth or paper sacks weighing 94 pounds and containing 1 cubic foot by loose volume. Cement for large projects may be referred to in terms of barrels containing 376 pounds, the equivalent of 4 sacks. Cement is also shipped in bulk by rail, ship, or by trucks equipped with special bodies.

Storage of Cement

Cement will retain its quality indefinitely if it does not come in contact with moisture. If it is allowed to absorb appreciable amounts of moisture it will set more slowly and its strength will be reduced. In storing sacked cement the warehouse or shed should be air tight as possible, sacks should be stacked close together to reduce the circulation of air, but they should not be stacked against outside walls. The sacks should be stacked on a raised floor, on pallets or on a platform at least 8 inches off the ground. If they are to be stored for long periods of time the cement may develop what is known as warehouse pack. This condition results from tight packing; however, the cement retains its quality. Warehouse pack can be corrected by rolling the sack on the floor.

On small jobs or where there is no shed or other building in which to store cement, the sacks may be placed on a raised wood platform. Waterproof tarpaulins should be placed over the pile to protect the cement against rain. The tarpaulins (Figure 95) should extend over the edges of the platform to prevent rain from collecting on it and thus reaching the bottom sacks. Bulk cement is usually transferred to elevated airtight and weather proof bins. Ordinarily it does not remain in storage very long but under these conditions it could be stored for a relatively long time without deterioration.

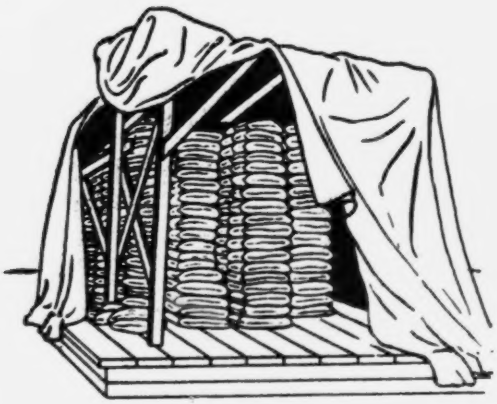


FIGURE 95. Cement stored under a tarpaulin

CEMENT SIEVES

Sieves

The gradation of particle size distribution of aggregates is determined by a sieve analysis. The standard sizes used for this purpose are number 4, 8, 16, 30, 50, and 100 for fine aggregate and 6 inch, 3 inch, 1 1/2 inch, 3/4 inch, 3/8 inch, and No. 4 for coarse aggregate. These sizes are based on square openings, the size of the openings in consecutive sieves being related by a constant ratio. A No. 4 sieve has 16 holes per inch and a No. 8 has 64 holes per inch. The grading and maximum size of aggregate are important because of their effect on proportions, workability, economy, porosity and shrinkage.

SUMMARY

The ingredients of concrete are cement, sand, gravel, and water. There are five types of Portland cement. Each type has its own characteristics and use. Water which is safe for drinking is safe for making concrete. Aggregate constitutes the major bulk of concrete. Fine aggregate (sand) is separated from coarse aggregate (gravel) by the number 4 sieve. One of the factors which determines the strength of concrete is the water-cement ratio. The ratio of water and cement is usually expressed as the gallons of water per bag of cement. The additives that are used in concrete to make it easier to work, set faster and resist freezing are calcium chloride, and air-entraining. The ingredients of a standard concrete mix are one part cement, two parts sand, and three parts gravel. The two methods of mixing concrete are handmixing and machine mixing. The slump test measures the consistency of concrete.

QUESTIONS

1. What is concrete? ____________________.
2. What type of cement is used in large masses of concrete such as large dams?

   ____________________.
3. What effect will clay, silt, and rock dust in the aggregate have on concrete?

   ____________________.
4. How much flake-type calcium chloride is added per sack of cement to concrete?

   ____________________.
5. Air-entrained cement is designated by what mark on bags of Portland cement?

   ____________________.
6. What is the advantage of using air-entrained cement?

   ____________________.
7. What is the normal mixing time for concrete in a concrete mixer?

   ____________________.
8. What is the size of fine aggregates used in concrete mixtures?

   ____________________.
9. In a number eight sieve there are __________ openings per square inch.
10. A hardened mixture of cement, sand, gravel, and water would be the definition of ____________________.

11. Fill in the blanks below with the type of cement that corresponds to the descriptions given.

TYPES	DESCRIPTIONS
a. ______________________	(1) Produces less heat during hydration.
b. ______________________	(2) Sulfate resistant.
c. ______________________	(3) High early strength.
d. ______________________	(4) Most commonly used.
e. ______________________	(5) Used for massive concrete pours.

12. A concrete additive that enables concrete to resist freezing and to protect pavements from adverse effects of salts during snow removal is

____

13. What is the largest size of coarse aggregate normally used?

____

14. How would you store cement outside? ______________________

____

____

____

____

15. Why is it necessary to determine the moisture content of aggregate before preparing a concrete mix?

____

____

16. What type of apparatus is used for a slump test?

____

REFERENCES

1. Modern Masonry, Goodheart-Wilcox, Inc.

2. CDC 55233, Apprentice Mason, Volume 2

CONSTRUCTION LAYOUT

OBJECTIVE

Working as a member of a team, using materials, area, hand tools, and dimensions provided, lay out a site for construction of a concrete slab. Layout must be within ± 1/4 inch of tolerance. Instructor assistance may be provided on most parts of the task.

Using tools provided, prepare an area for a concrete form. The completed area must be smooth, compacted, and ready for construction of the form. Instructor assistance may be provided on most parts of the task.

INTRODUCTION

Construction layout is an important part of good masonry construction. If buildings are not laid out properly, the end product will not be in the proper shape or grade to serve the purposes required by the blueprints. It is important that all layouts be square and level.

One of the most important steps in concreting is to prepare the base. A poorly prepared base will result in cracking, heaving and shifting of the structure.

This study guide covers the following topics:

- General Layout Procedures
- Establishing Layout Lines
- Leveling
- Site Preparation

INFORMATION

Assignment for Day 2 and 3 read and study Chapter 7, Concrete Fundamentals, page 85 (subgrade preparation only) in textbook Modern Masonry.

GENERAL LAYOUT PROCEDURES

Hub stakes are usually set by the surveyor and serve to mark the exact corner location of a building or structure. They also serve as a reference for setting up the batter boards. Then the batter boards are set about 3 to 4 feet from each corner of the project. They hold the string lines that determine the building lines and preserve the corner locations. The string lines or building lines are attached to the batter boards and form the exact dimensions of the project.

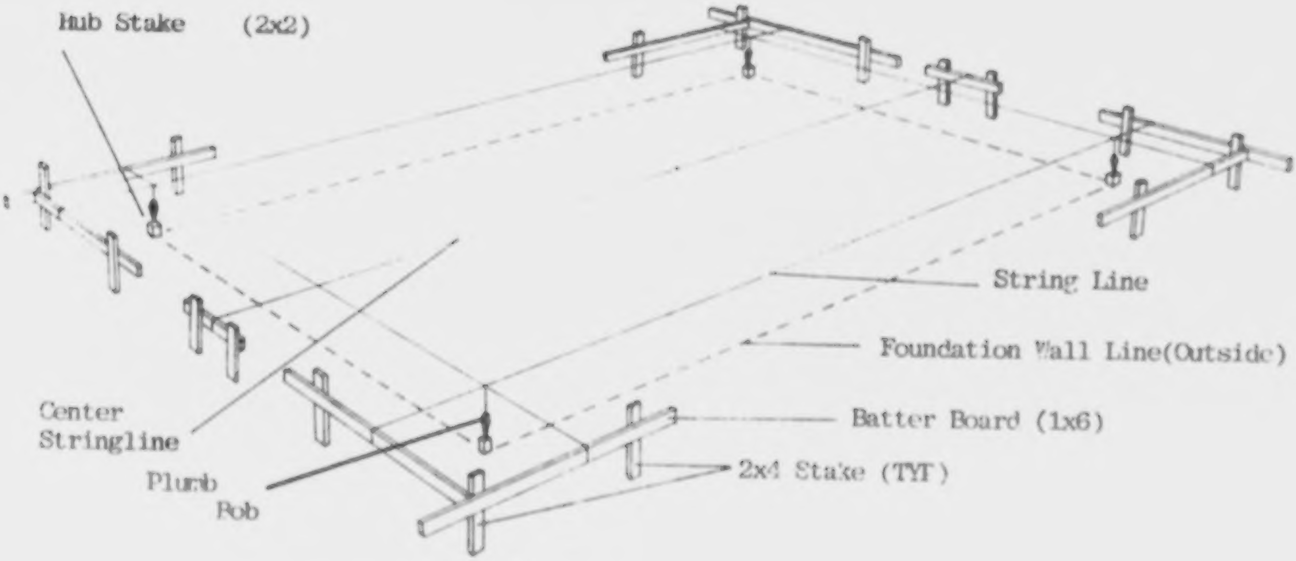

Hub Stake (2x2)
String Line
Foundation Wall Line(Outside)
Center Stringline
Batter Board (1x6)
2x4 Stake (TYP)
Plumb Bob

FIGURE 96. Completed Layout

The plumb bob or mason's plumb rule is used to locate the exact corner for the string lines from the hub stakes. A plumb bob is dropped or suspended at each hub stake so it barely rests on the nail driven to mark the exact dimensions. Then the string lines are brought together to form the corners. Figure 96 shows the completed layout work. A mason's plumb rule can be used by placing the end corner on the nail and bringing the strings together to form the corner.

ESTABLISHING LAYOUT LINES

After a site is cleared the layout lines need to be established before any construction can begin. This starts with setting the hub stakes. All the corners formed by the intersection of the outside surfaces of the foundation walls should make a hub stake driven. It is best to establish the hub stakes and layout lines with a transit, but can be done without. Line layout will be discussed in the following sections.

Squaring

The front stakes of a project are established from measuring out equal distances from a baseline and then getting the right distance between the two end stakes. A baseline is the center of a street, a curb, sidewalk, another building, etc. The back two stakes are then set by using the right triangle method of squaring (Figure 97). Nails are driven in the stake tops once the exact dimension is achieved and the corners are square. These nails mark the exact location of the corner on the hub stake. The right triangle method consists of first measuring 3' from one side of a corner; second, measuring 4' from the other side of the same corner; third, adjusting the lines until there is 5' between the two points. You can also use multiples of 3:4:5 such as 6:8:10, 9:12:15, etc. Diagonal measuring is the best way to check for squareness (Figure 98). When using the diagonal method of checking use a tape measure which will reach from corner to diagonal corner, and measure. Repeat the process using another tape measure across the other corners. The diagonals of a rectangle or a square will be equal in length if it is square. If not adjust the tapes until both measurements are the same and adjust the hub stakes. The overall dimensions of the building will also have to be rechecked. Remember an out of square project can result in continuous problems all thru the construction of the structure.

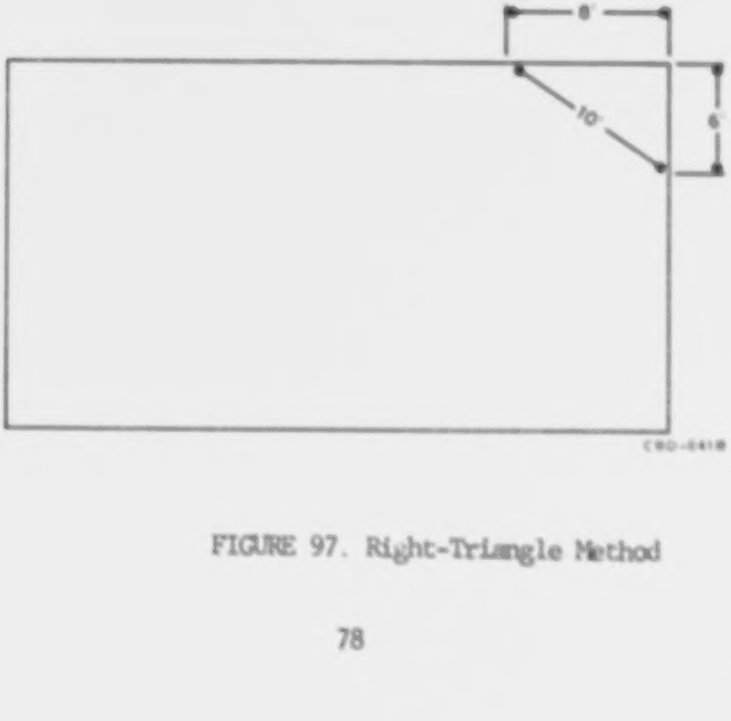


FIGURE 97. Right-Triangle Method

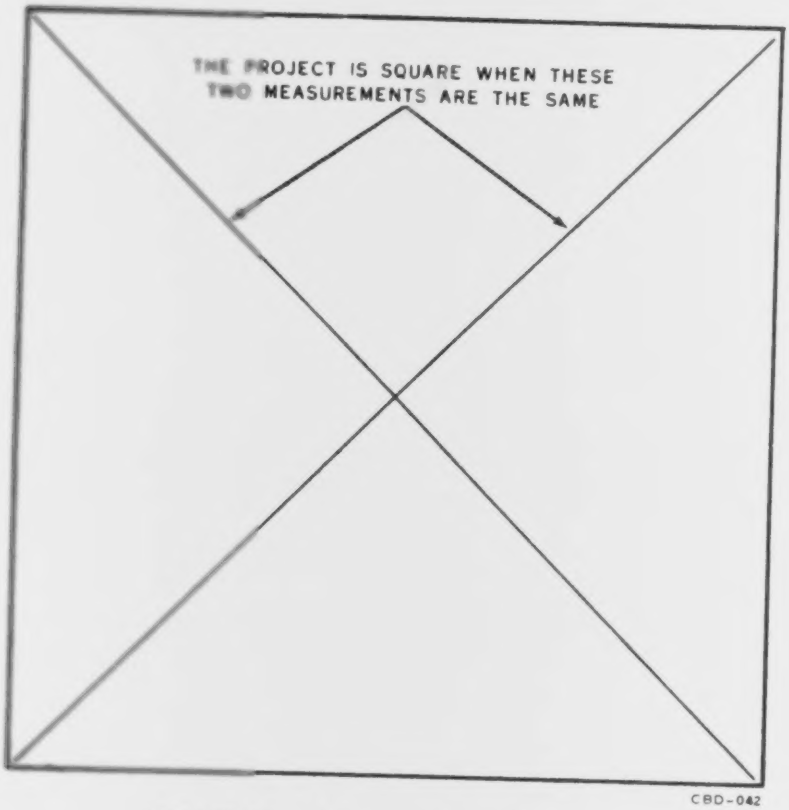

THE PROJECT IS SQUARE WHEN THESE
TWO MEASUREMENTS ARE THE SAME
CBD-042

FIGURE 98. Diagonal Checking

LEVELING

Once the hub stakes are set and the project dimensions determined, the batter boards must be set up to hold the string lines. The batter boards must all be set at the same level. One method of leveling the batter boards is to have them set by a surveyor, which can be costly. Another very reliable method that can be used is a water level. Figure 99 shows how to use the water level.

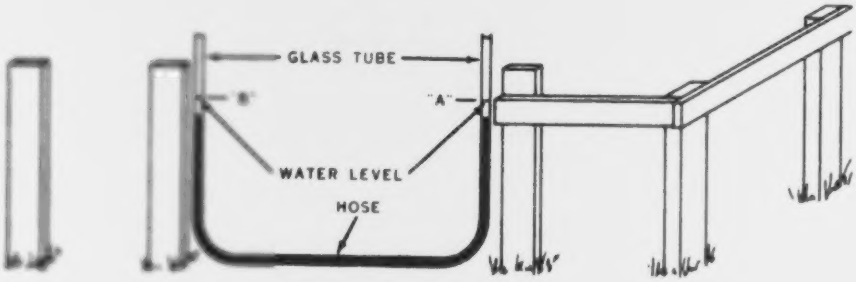

GLASS TUBE
"B"
"A"
WATER LEVEL
HOSE

FIGURE 99. Water Level

The stakes should be driven about 3 to 4 feet away from the hub stakes. Then the first ledger board placed at the height of the project, i.e., foundation wall. It should be leveled with a mason's plumb rule and then used as a reference for setting the remaining ledger boards. Then fasten the end of the tube to the ledger and raise the other end up a stake. When the liquid has leveled off at the same height as the ledger then mark it on the stake. Repeat this process until all the stakes are marked and all the ledger boards are nailed at their proper height. Once the batter boards are all up then the string lines can be positioned to determine the building lines. The string lines are held in position by making a saw kerf in the top of the ledger. When all of the preceeding steps are accomplished then the site preparation can take place.

SITE PREPARATION

Making preparations for placing of concrete is probably the most important factor concerning a quality concrete job. The subgrade (bed) must be prepared to receive the concrete, forms must be placed properly, and steel must be placed in the concrete to obtain the required strength.

Subgrades

Concrete can be placed satisfactorily on rock, clay, earth, and sand or gravel subgrades.

ROCK OR CONCRETE. When concrete is to be placed on a rock surface, roughen it and clean it thoroughly. Stiff brooms, water jets, high-pressure air, or wet sand-blasting can be used. Remove all traces of water and coat the surface with a 3/4-inch thick layer of mortar. Mix the mortar with fine aggregate. The water-cement ratio should be the same as for the concrete. Work the mortar into the surface with stiff brushes.

CLAY. If you are placing concrete on a clay subgrade, moisten the soil to a depth of 6 inches to help cure the concrete. Sprinkle it intermittently, so that it will work into the clay without becoming muddy.

EARTH. If concrete is to be placed on earth, have an engineer check it for adequacy of carrying a load. Dampen earth subgrades to a depth of 4 or 5 inches but do not saturate it. Dampening the earth will help cure the concrete and prevent the dry earth from extracting the moisture from the concrete.

SAND OR GRAVEL. When you place concrete on a sand or gravel subgrade, compact it with a mechanical compactor, as shown in Figure 100 or a hand tamper, as shown in Figure 101. If the subgrade is not compacted, cover it with burlap or tar paper before you place the concrete. Lap the tar paper no less than 1 inch and staple it. Join burlap together with wire and moisten it by sprinkling before you place concrete on it.

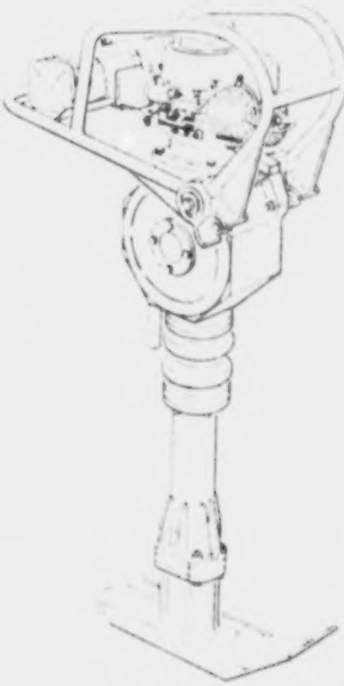


FIGURE 100. Mechanical Compactor

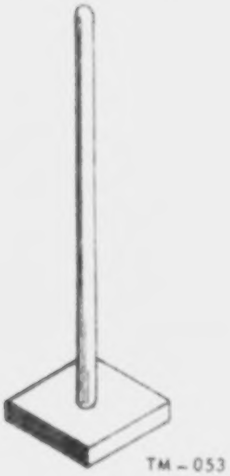


FIGURE 101. Hand Tamper

SUMMARY

Having the hub stakes layed out and set square and having level batter boards are important to good construction. It is your responsibility to insure that all forms are square and level. It is better to spend a few minutes checking to insure that all batter boards and layout lines are level and square than to spend hours or even days in re-doing a job that was not done properly.

It is also equally important that an adequate base be established before placing concrete. Methods of preparing the base include removing the surface soil and compacting the subgrade and fill material. The fill is composed of granular material combined with small binding materials. The fill is compacted in layers of not less than 6 inches and not more than 12 inches.

QUESTIONS

1. What is a hub stake?

2. What are batter boards used for?

3. Why is a plumb bob used?

4. What is one method of squaring a project?

5. What is used to level batter boards?

6. What is used to compact the subgrade?

REFERENCES

1. CDC 55233, Apprentice Mason

2. MODERN MASONRY, Goodheart-Wilcox, Inc.

PREPARING FOR CONCRETE

OBJECTIVE

Working as a member of a team, and using information and tools provided, build a form for concrete, with instructor assistance. The form must comply with the given instructions and be ready to receive concrete mixture.

INTRODUCTION

Concrete forms are made for molding concrete footings, foundation walls, and piers, etc. This type of construction is the reverse of other construction practices because the inside of the form is the finished or smooth side. The most important steps in form construction are placement and alignment to achieve a quality concrete project.

INFORMATION

Assignment for Day 3 and 4 read and study Chapter 10, Form Construction, Pages 161-174 in textbook, Modern Masonry. Using a separate sheet of paper, answer questions 1-20 on page 174. Do not write in the textbook.

One of the simplest forms constructed is the earth form. It can be used in subsurface construction if the soil is stable enough to retain the desired shape of the concrete. The advantage of this type of form is that it generally requires less excavation and has a greater settling resistance. Because of the obvious disadvantages of a rough surface finish, the use of earth forms is generally restricted to footings and foundations. If the excavation is greater than the width of the footing or if the soil is such that the sides of the trench will not stand until the concrete can be poured, use wooden footing forms.

SUMMARY

The importance of the correct type, design, and application of forms cannot be over-stressed. The strength and finished appearance of the concrete is governed by the workmanship put into the construction of the forms.

Strong forms are important to good construction. It is your responsibility to insure that the forms you use for a pour are the best you can build. No matter how good the forms may look, it's better to spend a few minutes checking the forms than to lose hours repairing a broken form.

QUESTIONS

1. Name four materials commonly used for form construction?

2. What is the function of wales?

3. Wall forms rest on the ______________________________.

4. What size lumber is ordinarily used for forms to pour a 4 inch thick slab?

5. What are the vertical members of a wall form called?

REINFORCEMENT MATERIALS

OBJECTIVE

Working as a member of a team, exercising safety precautions and using masonry tools and equipment, prepare and install reinforcement into concrete forms. Instructor assistance may be provided for most parts of the task.

INTRODUCTION

Most of us have seen modern football stadiums, hospitals, aircraft hangars and skyscrapers built of concrete. Have you ever wondered how these structures were built to withstand the loads that were imposed upon them? This study guide should give you some fundamental insight into what types of reinforcement are used and where they are used.

INFORMATION

Assignment for Days 4 and 5, read and study Chapter 7, Concrete Fundamentals, pages 91-92 (Joints in Concrete) and pages 95-98 (Reinforced Concrete to Placing Steel Reinforcement) in textbook: Modern Masonry.

In order to reinforce a concrete structure, the reinforcement must be cut and sometimes bent to fit into the forms. Reinforcement rods, woven or welded wire can be cut with a hacksaw, bolt cutters, a torch, or a re-bar cutter-bender. The bolt cutters and the cutter-bender are limited to cutting only certain sizes, where as the hacksaw or the torch can cut almost any size. When large numbers of rods need to be bent to various shapes they are bent on a bar-bending table like that shown in Figure 102.

The reinforcement can be installed after the forms are built but it is generally placed in the forms as they are built. The reinforcement in vertical forms (wall forms, column forms, etc.) is supported and spaced by the use of tie wires. But you use anchors and manufactured units such as precast concrete blocks, or chairs, bolsters, and stirrups to support steel reinforcement for concrete slabs. Figure 103 and 104 illustrates a precast unit and manufactured support and spacers.

The height of the supports used to hold the reinforcing material in a concrete slab is determined by the concrete protective cover specified. Footings and other principal structural members (against the ground or that is exposed to the weather) should have at least 3 inches of concrete between the steel and the ground and have a 2 inch covering of concrete over the steel. Reinforcement for walls, columns, beams, etc., are covered with concrete as stated in the specifications for the job. If anchor bolts are to be placed in the concrete, some means of anchorage should be provided as illustrated in Figure 105.

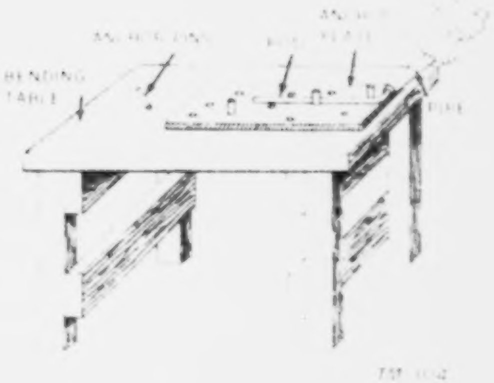
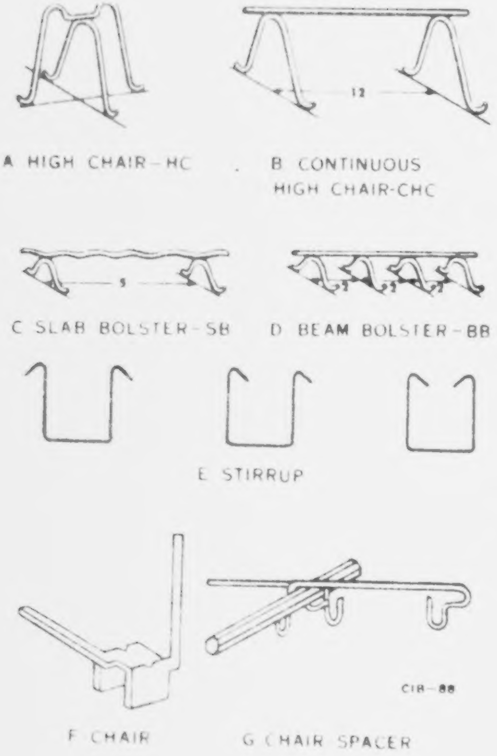

BENDING TABLE
ANCHOR PINS
ANCHOR PLATE
PIPE

FIGURE 102. Bar-Bending Table


12
A HIGH CHAIR-HC
B CONTINUOUS HIGH CHAIR-CHC
5
C SLAB BOLSTER-SB
D BEAM BOLSTER-BB
E STIRRUP
CIB-88
F CHAIR
G CHAIR SPACER

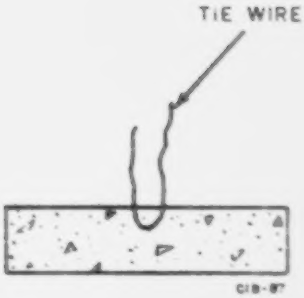

TIE WIRE
CIB-87

FIGURE 103. Precast Concrete Block

FIGURE 104 Typical Supports and Spacers

Anchor bolts or other types of fastening devices are used to fasten or secure a variety of different objects. They fasten metal rails to concrete walls, secure machinery in place, or hold the wooden sills of a structure down. Whenever possible the anchor bolts should be set in place at the time of pouring the concrete. But it is still possible to fasten almost anything to a concrete or masonry surface. A variety of special fasteners are available for use today, Figure 106 shows a couple of these fasteners.

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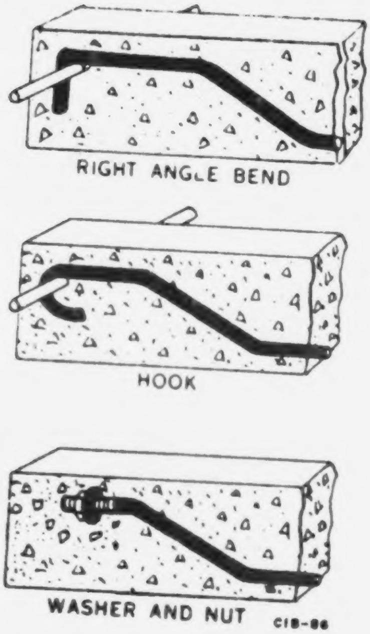
RIGHT ANGLE BEND
HOOK
WASHER AND NUT
CIB-86

FIGURE 105. Types of Anchorage

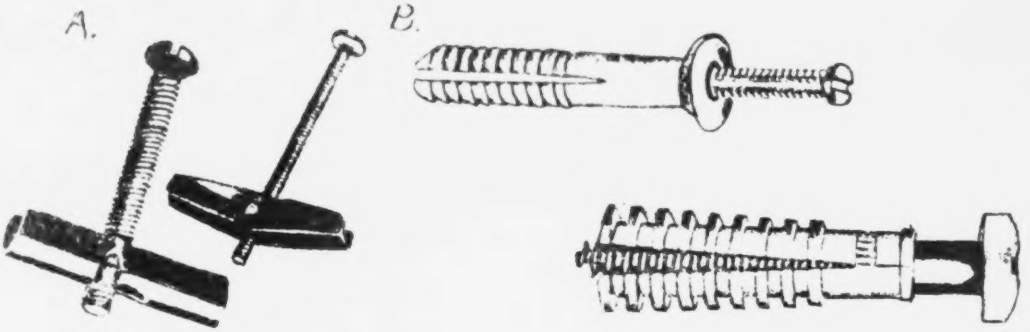

FIGURE 106. A. Shows Typical Toggle Bolts

B. Shows Expansion Shields and a Screw and Lag Bolt

Two popular types of anchor bolts which are set in place before the concrete is poured are the pipe sleeve and the hooked anchor bolt. Both are illustrated in Figure 107.

The pipe sleeve anchor bolt is a good type of anchor to use when anchoring machinery. The sleeve on the pipe sleeve type of anchor should be at least 1 inch larger in diameter than the bolt. This permits the bolt to be shifted, which will compensate for any small error that may occur during the positioning of the equipment. The sleeve should be set level with the top of the floor, when it is finished. Pack the sleeves with a rag oakum or newspaper to prevent concrete from entering during the concreting operation.

The hooked type anchor bolt is most commonly used to anchor a wood sill to a concrete wall, slab, or a masonry wall. Figure 108 illustrates a wooden sill fastened to a slab floor.

Anchor bolts with a type of anchorage as illustrated in Figure 105 can also be used in most areas of construction. Care must be taken when you place the concrete around the bolts to keep them from shifting or changing the alignment of the bolt. A templet as shown in Figure 109 should be used to align the anchor bolts. The holes drilled thru the templet, to receive the anchor bolts, should be 1/16 of an inch larger than the bolt to permit a slight adjustment of the bolt. This slight adjustment is to shift the bolt to a vertical position. If the anchor bolt is not in a vertical position it makes the attachment of the sills very hard.

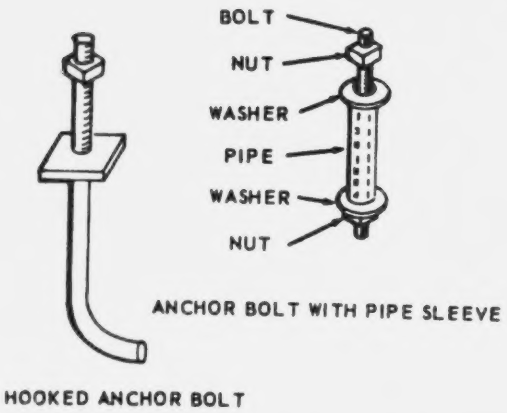

FIGURE 107. Anchor Bolts Which Are Set In Place Before Concreting

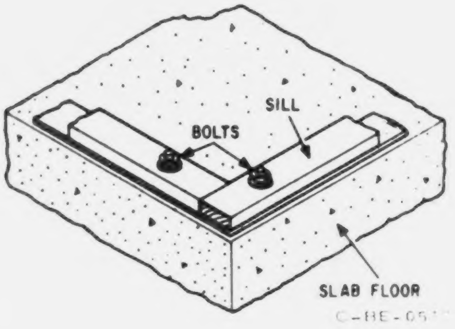

FIGURE 108. Typical Sills Fastened To a Slab Floor

The special fasteners as illustrated in Figure 107 are put in a hole in the concrete or mortar. The holes are drilled with an electric drill with a carbide-tipped drill bit. Another method uses a star drill to drill or otherwise punch a hole through the concrete. These anchors range in various sizes to accommodate the various weight loads imposed on the bolts. These anchors are not recommended for use in brickwork, but can be installed in the mortar joint and be as secure as you will ever need.

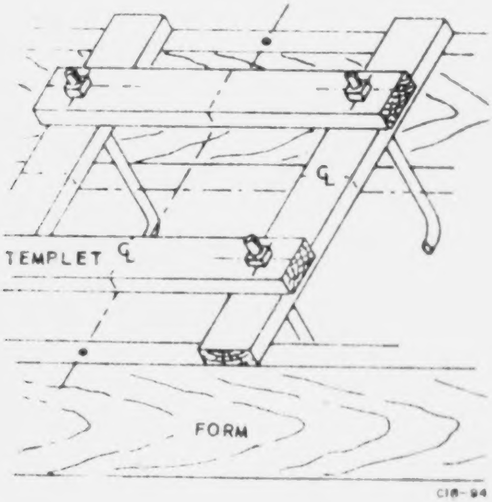

FIGURE 109. Templet for Anchor Bolts

SUMMARY

Steel is very strong; therefore, it is often used to reinforce concrete structures. Reinforcement steel is available in rods of various shapes and sizes as well as wire mesh, both woven and welded. The selection of the type and amount of reinforcement needed depends on the structure and the strength required. The reinforcement used in walls is usually erected in place. The reinforcement used in slabs may be assembled prior to installation. Wire, precast concrete metal spacers and supports are used to position the reinforcement in the forms. To be able to cut, bend, and fabricate reinforcement steel, you will need to know how to use bending tables, bolt and rebar cutters and other types of tools and equipment.

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QUESTIONS:

1. Why is steel the best material for reinforcing concrete?
2. You have a reinforcement rod one inch in diameter. What is the bar number of this bar?
3. Name the three types of reinforcing materials.
4. Explain the method of bending steel reinforcing bars.
5. Why should all the loose scale be removed from steel reinforcement bars before they are used?
6. Name three things that are used to space and hold reinforcement materials.
7. What is used to hold an anchor bolt in place when pouring concrete?
8. Why should a pipe sleeve be filled before the concreting operation.
9. What type of anchor bolt is most commonly used to anchor a wood sill to a masonry wall?
10. When anchoring machinery what type of anchor bolt is used.

REFERENCES

1. MODERN MASONRY, Goodheart-Wilcox Co., Inc.
2. CDC 55233, Apprentice Mason

MIXING AND PLACING CONCRETE

OBJECTIVE

Working as a member of a team, exercising safety precautions, and using masonry tools and equipment, measure, mix, perform field test, place, consolidate, and finish the concrete project. Concrete must be ready for the curing process. Instructor assistance may be provided for most parts of the project.

INTRODUCTION

The construction of a concrete structure on an Air Force installation requires the skill and knowledge of several Civil Engineering AFSCs. If the structure is a large one, it will be surveyed and staked off by Site Development personnel. Preparation of the subgrade and base course material for concrete slabs requires the efforts of Equipment Operator Specialists. The responsibility of building and placing forms, for wall or slab structures, lies with the Carpentry Specialist. None of these specialists, however, will be as involved, nor will they be nearly as concerned that the completed project be of high quality, as you, the Mason will be.

To make certain that each phase of the project conforms to project specifications, you may be present when the site is surveyed and during subgrade and base course preparation. It is your duty and responsibility to advise carpenters during form construction and placement. Since the ultimate goal is a structure of good, strong, high-quality concrete, you will install reinforcing materials, determine the mixture ratio, order ready-mix or mix the proportioned ingredients yourself, and then transport, place, and finish the concrete.

INFORMATION

Assignment for Days 4 and 5, read and study Chapter 7, "Concrete Fundamentals", pages 81 thru 89 in textbook, MODERN MASONRY.

SUMMARY

Good quality concrete must have the correct proportion of properly mixed ingredients, however, this is only the starting point. Poor transporting and handling practices can ruin the most carefully measured and properly mixed concrete. Several means of transporting concrete are available. Transit-mix trucks usually are used to deliver concrete to larger construction sites. On smaller jobs, wheelbarrows or buggies may be used. The means of transportation requires careful planning and, at times, must be used in conjunction with chutes to place concrete. Chutes must be sloped correctly, and if the distance concrete must travel through a chute is too far, it will tend to dry out or segregate.

If this situation develops other methods and means must be considered and applied to keep the quality of the job at the desired level.

The quality of concrete can be improved with the use of vibrators to consolidate it during the placing operation.

After concrete is placed in forms, it is finished by screeding; hand tamping, if required; floating while the concrete is still plastic; troweling; brooming; edging, if necessary; then jointing or grooving if required.

Changes in temperature will cause concrete to expand and contract. This action may result in cracking or buckling of the concrete. To relieve this condition expansion joints are installed.

QUESTIONS

1. Why is it a good practice to oil concrete forms?
2. Where should concrete be poured?
3. Concrete should not be allowed to drop freely ______________________________ ______________________________.
4. When concrete is to be placed on hardened concrete, what must be done?
5. What is meant by screening?
6. If the finishing operation is performed while the bled water is present, what can result?
7. What is done to a concrete surface to produce a smooth, dense surface?
8. When are the forms removed from the concrete?

REFERENCES

1. MODERN MASONRY, Goodheart-Wilcox Company, Inc.
2. CDC 55233, Apprentice Mason

CURING CONCRETE

OBJECTIVE

Using given procedures, and with instructor assistance for most parts of the task, apply the material necessary to protect the concrete from extremes of weather and to effect a satisfactory cure of concrete slabs and structures.

INTRODUCTION

Although concrete is one of the most useful building materials developed by man, it requires much care immediately after initial placement. This care we will call curing. Initial concrete curing performs two important functions in concrete. (1) Prevents loss of moisture, insuring water available to complete hydration process in concrete; and (2) maintains temperature level to insure this complete chemical reaction. This study guide will describe the curing operation and different methods used in curing concrete.

INFORMATION

Assignment: Day 6, read and study Chapter 7, Concrete Fundamentals, pages 89-90, (Curing Concrete), in textbook: MODERN MASONRY.

SUMMARY

Strengths obtained in concrete are primarily regulated by the curing process. So now, you see why it is of tremendous importance in concrete operations. All preliminary care taken in selection of materials, mixing, forming and placement can be completely destroyed if concrete curing is not properly accomplished.

QUESTIONS

1. When should curing operations begin?
2. What can be done to protect new concrete against evaporation?
3. Why does all concrete need to be cured?
4. What is the best method of curing?
5. What is the ideal temperature for curing concrete?

REFERENCES

1. MODERN MASONRY, Goodheart-Wilcox Company, Inc.
2. CDC 55233, Apprentice Mason

CONCRETE MAINTENANCE AND REPAIR

OBJECTIVE

Working as a member of a team, exercise safety precautions, and using masonry tools and equipment, remove, clean and store forms, and make patches as necessary to finish the concrete. Instructor assistance may be provided for most parts of the task.

INTRODUCTION

Concrete is one of our most important building materials. It is used in almost every type and size of architectural structure; in footings, foundations, floor and roof systems, walks, and driveways to name a few. Concrete is a major building material, so it is necessary to know when to remove the forms as well as how to finish the concrete behind the forms. Another important aspect of using concrete as a building material is the maintenance or repair of a concrete structure.

INFORMATION

Assignment for Day 6, reading and study Chapter 7, "Concrete Fundamentals" (Form Removal), page 89 in text, MODERN MASONRY.

Form Removal

The time to remove forms will vary from job to job. It is generally advantageous to leave forms in place throughout the curing period. However, it may be necessary to strip forms earlier, so they can be reused.

Never remove forms before the concrete can support its own weight or any other load which may be placed on it during construction. Forms for walls, columns, and footings can usually be removed before removing forms for floors or beams. Before removing forms, check with the engineer on the job, because the strength of concrete is affected by the materials used, temperature, and many other conditions.

Strip forms carefully to avoid damage to the surface of the concrete. When it is necessary to wedge against the concrete, use wood wedges rather than a nailbar or other metal tool. Never jerk the forms off as this will certainly break the edges of the concrete.

If the forms are going to be re-used, then they will be cleaned and oiled after removal. The faces of the forms should be stacked together and stored flat in a covered area. This practice will extend the life of your forms.

Patching Concrete

When the forms are removed, inspect concrete for rock pockets, ridges at the form joints, bolt holes, and form removal damage. The fresh concrete must be repaired and ordinarily, repairs will bond better and be more durable if made as soon as the forms are removed.

Remove ridges or bulges by rubbing them with a stone or by grinding them with a portable power grinder. Fill bolt holes, tierod holes, or nailholes by packing mortar into them. Mix the mortar as dry as possible, with just enough water so that it will compact into place.

Defective areas, such as rock pockets or honeycomb, must be chipped out to solid concrete. Cut the edges at right angles to the surface or slightly undercut to provide a key at the edge of the patch. Keep the surface of the hole to be patched moist for several hours before applying the mortar.

Figure 110 shows the incorrect and correct methods of patching a concrete surface. Do not feather the edges of a patch, because they will break down and result in chipping. Before pouring the new concrete mix in the patch, be sure to soak the concrete for several hours. This is especially important in the repair of old concrete. Without wetting, a good bond cannot be achieved.

As a mason in a civil engineering organization on an Air Force installation it is your responsibility for the maintaining of many different concrete structures. This maintenance is to keep it as structurally sound as to traffic, climate, funds, materials, equipment and availability of the labor, will permit. Prompt and adequate maintenance will greatly extend the useful life of a concrete structure. To keep it sound it may require that large areas be cut, broken, or drilled out to effectively repair the concrete.

Cutting Concrete

Concrete can be cut with a concrete saw equipped with a diamond tip blade. The cut should be made as soon as the concrete will support the saw. This type of equipment is used extensively to make a contraction joint in a slab sidewalk or roadway.

Before using a concrete saw, you will need to perform a preoperation check of the saw. Sweep the area to be sawed, and mark a line where the sawing should be done. Always wear goggles and observe all safety precautions while operating the saw.

A cold chisel or bolster can be used with a hammer to cut or chip concrete. This hand equipment is especially useful for making repairs to concrete.

Breaking Concrete

Concrete can be broken with heavy bars and sledge hammers. However, if a large quantity is to be broken, use an impact hammer or a paving breaker. Follow the manufacturer's instructions when using this power equipment.

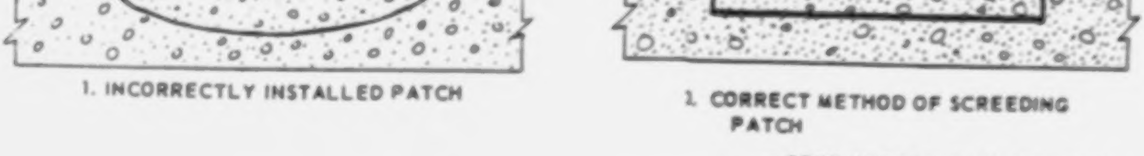
Before using an electric or pneumatic hammer to break concrete, you should perform a preoperation inspection of the hammer. Sweep the concrete around the defective area and mark lines indicating where concrete is to be broken. Wear goggles and gloves while operating the hammer.

Drilling Concrete

Concrete can be drilled by using a carbide or diamond tip drill in a heavy duty drill motor. Holes should be drilled before the concrete is completely set, because it will drill easier. However, holes can be drilled in old concrete.

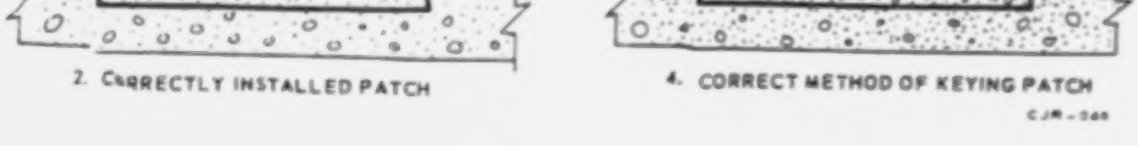
Always check a drill for condition before use. Sweep around the defective area and mark lines to show where drilling is to be done. Connect drill to electric power and drill out area needed.

You can also drill a hole by using a star drill with light taps from a hammer. When using a star drill, turn it after each tap and clean the hole occasionally with compressed air or by blowing into the hole through a soda straw. Wear goggles to protect your eyes when drilling, cutting or breaking concrete.



1. INCORRECTLY INSTALLED PATCH

1. CORRECT METHOD OF SCREEDING PATCH



2. CORRECTLY INSTALLED PATCH

4. CORRECT METHOD OF KEYING PATCH

FIGURE 110. Patching a Concrete Slab

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SUMMARY

When repairing concrete, the objective is to return the structure to as near its original strength and condition as possible.

When removing wall forms, take care not to damage the wall surface. Use wooden wedges to pry the form away from the wall.

Carborundum stones are used to clean stains and excess concrete from wall surfaces. Voids may be filled using either grout or a slurry paste. To obtain the design strength of concrete it must be kept moist during the first few days after the concrete is poured. The designed strength of concrete cannot be obtained unless proper curing procedures are followed over a specified period of time. Proper curing can assure a high quality final product.

QUESTIONS

1. What is the first step in rigid pavement repair and maintenance?
2. How is a concrete patch cured?
3. What is used to fill concrete repairs?
4. Why should care be taken in removing forms?
5. Why would you use a carborundum stone?

REFERENCES

1. MODERN MASONRY, Goodheart-Wilcox Company, Inc.
2. CDC 55233, Apprentice Mason

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WORKBOOKS
J3ABR55231 000-I-2-P1 thru I-11-P2

TECHNICAL TRAINING

Masonry Specialist

INTRODUCTION TO MASONRY

April 1983

USAF TECHNICAL TRAINING SCHOOL
3770 Technical Training Group
Sheppard Air Force Base, Texas 76311

Designed for ATC Course Use

DO NOT USE ON THE JOB

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3770 Technical Training Group
Sheppard Air Force Base, Texas

WB J3ABR55231 000-I-2-P1
April 1983

SAFETY

OBJECTIVE

Erect and remove a scaffold and ladder while exercising safety precautions. May have limited instructor assistance.

Lift a heavy or cumbersome object from the floor to waist height. Must use correct procedures. May have instructor assistance on the hardest parts.

Given pictures containing safety hazards, identify the hazards and name the procedures for reporting or correcting them. Instructor assistance may be provided on most parts of the task.

Given information on electrical hazards and precautions, explain the procedures involved in dealing with the hazards.

Using information provided, identify the procedures for emergency treatment of person involved in acid spill.

EQUIPMENT

	Basis of Issue
SG J3ABR55231 000-I-2	1/student
WB J3ABR55231 000-I-2-P1	1/student
Scaffolding	1/12 students
Ladder	1/12 students

MISSION I

PROCEDURE

Erect and remove a scaffold and ladder while exercising safety precautions. May have limited instructor assistance.

1. Erect two stages of sectional steel scaffolding using class notes, SG J3ABR55231 000-I-2 and guidance from your instructor.

   a. The scaffold must conform to accepted safety rules and standards.

   b. Have your instructor evaluate your performance after the scaffold has been erected.

   c. Disassemble the scaffold in reverse order of erection.

   d. Return all scaffold parts to the appropriate storage area designated by your instructor.

2. Using a single ladder provided by the instructor, perform the following:

   a. Visual inspection

      (1) Parallel rails for cracks

      (2) Rungs for cracks and breaks

      (3) Safety shoes in good condition

   b. Erection

      (1) Place the base of the ladder against the bottom of the wall.

      (2) Keep the base from slipping and raise the ladder hand over hand until it is vertical with the wall.

      (3) Pull the base of the ladder 1/4 the length of the ladder away from the wall.

      (4) Reverse the erection procedures to take it down.

   c. Store the ladder in an area designated by your instructor.

MISSION II

PROCEDURE

Lift a heavy or cumbersome object from the floor to waist height. Must use correct procedures; may have instructor assistance on the hardest parts.

NOTE: The instructor will provide you with an object to lift.

1. Go to the object to be picked up.

2. Assume the correct position to lift the load.

3. Lift the load to a full upright position.

4. Lower the load to its original position.

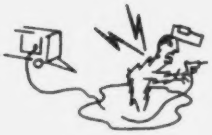
MISSION III

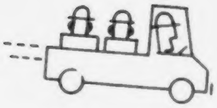
PROCEDURE

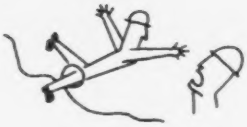
Given pictures containing safety hazards, identify the hazards and name the procedures for reporting or correcting them. Instructor assistance may be provided on most parts of the task.

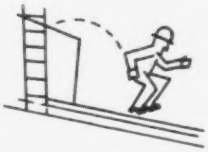
1. Identify each of the following safety hazards. Write your answer in the space provided beneath each picture.

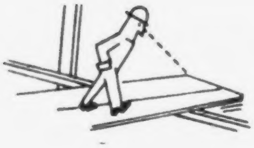
2. Name the procedures to eliminate each safety hazard. Write your answer in the blanks beside each picture.

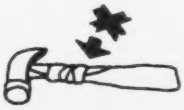


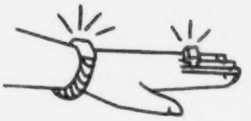


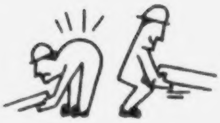


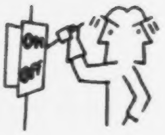








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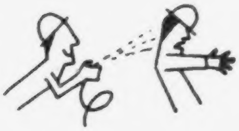
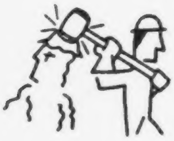




3. Name the procedures for reporting a safety hazard if it can not be corrected by you or your supervisor.

____

____

____

____

____

____

MISSION IV

PROCEDURES

Given information on electrical hazards and precautions, explain the procedures involved in dealing with the hazards.

1. What are the main hazards of working with electrically powered tools?

2. List the precautions to take while using electrically powered tools.

   a.

   b.

   c.

   d.

   e.

   f.

3. Tools which are not double insulated must be ______________.

MISSION V

PROCEDURE

Using information provided, identify the procedures for emergency treatment of a person involved in acid spill.

1. List the protective clothing which should be worn while working with acid.

   a. ______________ f. ______________

   b. ______________ g. ______________

c. ______________________ h. ______________________

d. ______________________ i. ______________________

e. ______________________

2. Name the steps to take in the event you or someone is exposed to acid via a spill.

   a.

   b.

   c.

3. List the effects of what an acid burn or spill could do.

   a.

   b.

   c.

MAINTENANCE OF TOOLS AND EQUIPMENT

OBJECTIVES

Working as a member of a team, using instructions and checklists, and exercising safety precautions, perform preoperational inspections and adjustments or repairs on masonry tools and equipment, with instructor assistance.

Working as a member of a team, using instructions and checklists, and exercising safety precautions, select, clean, sharpen, lubricate or maintain masonry tools and equipment. Limited instructor assistance may be provided.

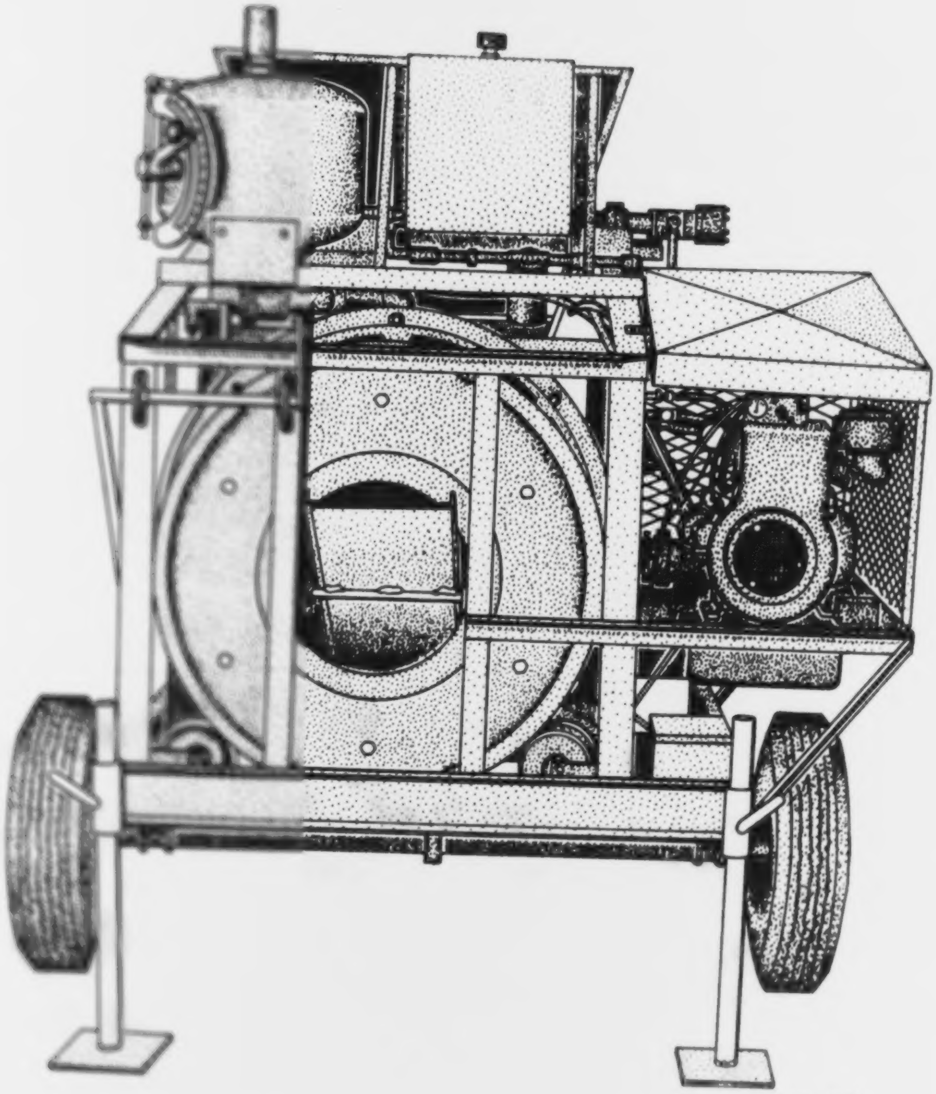
EQUIPMENT	Basis of issue
SG J3ABR55231 000-I-3	1/student
WB J3ABR55231 000-I-3-P1	1/student
Manufacturer's Checklist and Manuals	1/12 students
Concrete Mixer	1/12 students
Mortar Mixer	1/12 students
Concrete Saw	1/12 students
Tile Saw	1/12 students
Bench Saw	1/12 students
Radial Arm Saw	1/12 students
Electric Drill	1/12 students
Circular Saw	1/12 students
Bolt Cutter	1/6 students
Crosscut Handsaw	1/6 students
Electric Saw	1/6 students
Tin Snips	1/6 students
Brick Set	1/6 students
Brick Hammer	1/6 students
Tile Nipper	1/6 students
Pick	1/6 students
Spade	1/6 students
Star Drill	1/6 students
Brace and Bit	1/6 students
Level	1/6 students
Plumb Bob	1/6 students
Electric Hammer	1/12 students

MISSION I

PROCEDURE

Working as a member of a team, using instructions and checklists, and exercising safety precautions, perform preoperational inspections and adjustments or repairs on masonry tools and equipment, with instructor assistance.

1. Concrete Mixer.



CJR-051

a. Safety precautions

  (1) Remove all jewelry.

  (2) Check safety chain holding hopper in "UP" position.

  (3) Keep all personnel clear of machine while in operation.

  (4) Stay upwind from cement dust.

b. Preoperation checks

  (1) Check oil and fuel levels

  (2) Check lock stabilizing standards

  (3) Check skip/hopper safety locks

  (4) Check drum for operation

    (a) Cleanliness

    (b) Fittings and gears

  (5) Check hoisting cables for condition

  (6) Check tow bar for operation

c. Maintenance

  (1) Clean

    (a) Wash outside with water hose

    (b) Clean inside of drum with wooden paddle or fill ½ full of aggregate and operate 5 minutes.

  (2) Lubrication

    (a) Maintain proper oil level in engine

    (b) Lubricate grease fittings

    (c) Oil moving joints

  (3) Repair/maintain

    (a) Replace drum blades if badly worn

    (b) Check and tighten bolts, nuts, and screws

    (c) Repair or replace inoperative parts

    (d) Clean and adjust engine spark plug

    (e) Check engine fuel tank for dirt and water

2. Concrete Saw

   a. Safety precautions

      (1) Keep hands and feet away from saw blade while in operation

      (2) Wear goggles while operating saw

      (3) Remove all jewelry

      (4) Sweep area from sawing

   b. Preoperation checks

      (1) Check engine fuel/oil level

      (2) Check blade for condition and security

      (3) Check overall saw for condition and security of parts

   c. Maintenance

      (1) Clean

         (a) Remove dirt from engine cooling fins

         (b) Keep holes in dust guard free of dirt

         (c) Remove belt guard and clean clutch area

         (d) Clean engine air filter

      (2) Lubricate - check engine fuel/oil level

      (3) Repair/maintain

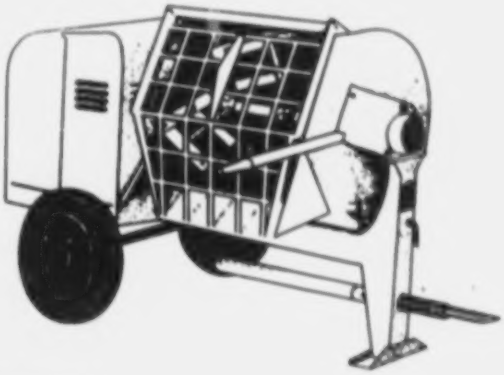
         (a) Check and tighten nuts, bolts, and screws

         (b) Clean and adjust engine spark plug

         (c) Check fuel tank for dirt and water

         (d) Repair or replace inoperative parts

3. Mortar mixer



a. Safety precautions

    (1) Remove all jewelry
    (2) Insure mixing drum is disengaged
    (3) Keep all personnel clear of machine while in operation
    (4) Do Not place hands inside the drum cage while mixing plaster

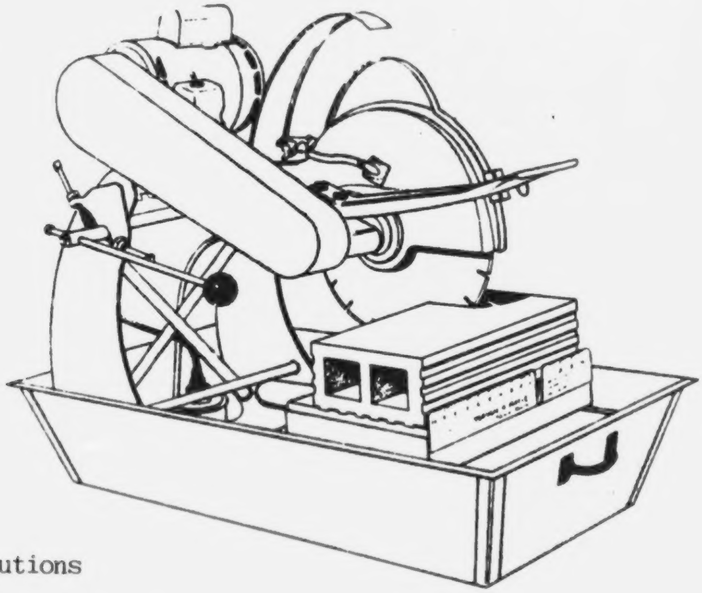
b. Preoperation checks

    (1) Check engine oil and fuel levels
    (2) Check general condition of parts
    (3) Check security of components

c. Maintenance

    (1) Clean
        (a) Wash outside with water hose
    (2) Lubricate
        (a) Maintain correct oil level in engine
        (b) Lubricate grease fittings
        (c) Oil moving joints
        (d) Keep small amount of grease on main gear teeth
    (3) Repair/maintain
        (a) Replace drum blades if necessary
        (b) Check and tighten bolts, nuts, and screws
        (c) Repair or replace inoperative parts.
        (d) Clean and adjust engine spark plug
        (e) Check engine fuel tank for dirt and water

4. Tile Saw



a. Safety precautions

(1) Make sure saw has 3-prong grounded plug

(2) Wear goggles

(3) Wear rubber gloves

(4) Stand on a rubber mat while operating

b. Preoperation checks

(1) Check pan for water

(2) Check guard and blade assembly for free operation

(3) Check pump for operation

c. Maintenance

(1) Clean

(a) Remove dust from exterior parts

(b) Drain and clean water pan as required

(2) Maintain/repair

(a) Check V-belts for tension and condition

(b) Check blade guard for condition and security

(c) Check blade assembly for operation

(d) Check overall condition and security of parts

5. Electric saws

a. Safety precautions

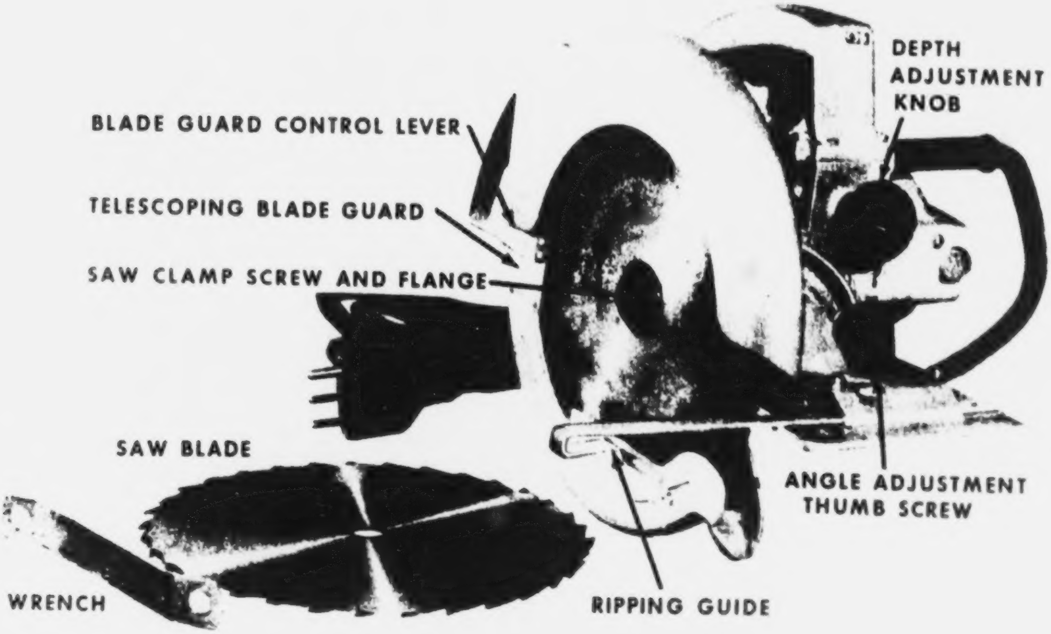
(1) ALWAYS wear goggles

(2) Keep hands away from cutting blade

(3) Use the right saw for the purpose for which it was designed

(4) Disconnect the power source before making any adjustments to the saws

b. Portable electric saw


DEPTH ADJUSTMENT KNOB
BLADE GUARD CONTROL LEVER
TELESCOPING BLADE GUARD
SAW CLAMP SCREW AND FLANGE
SAW BLADE
ANGLE ADJUSTMENT THUMB SCREW
WRENCH
RIPPING GUIDE

(1) Preoperation checks

(a) Adjust depth of cut

(b) Set angle for desired angle of cut

(c) Check guard assembly

(2) Maintenance

(a) Clean - Wipe dirt and dust off of exterior of saw

(b) Lubricate - Oil the electric motor and grease gears as specified by the manufacturer

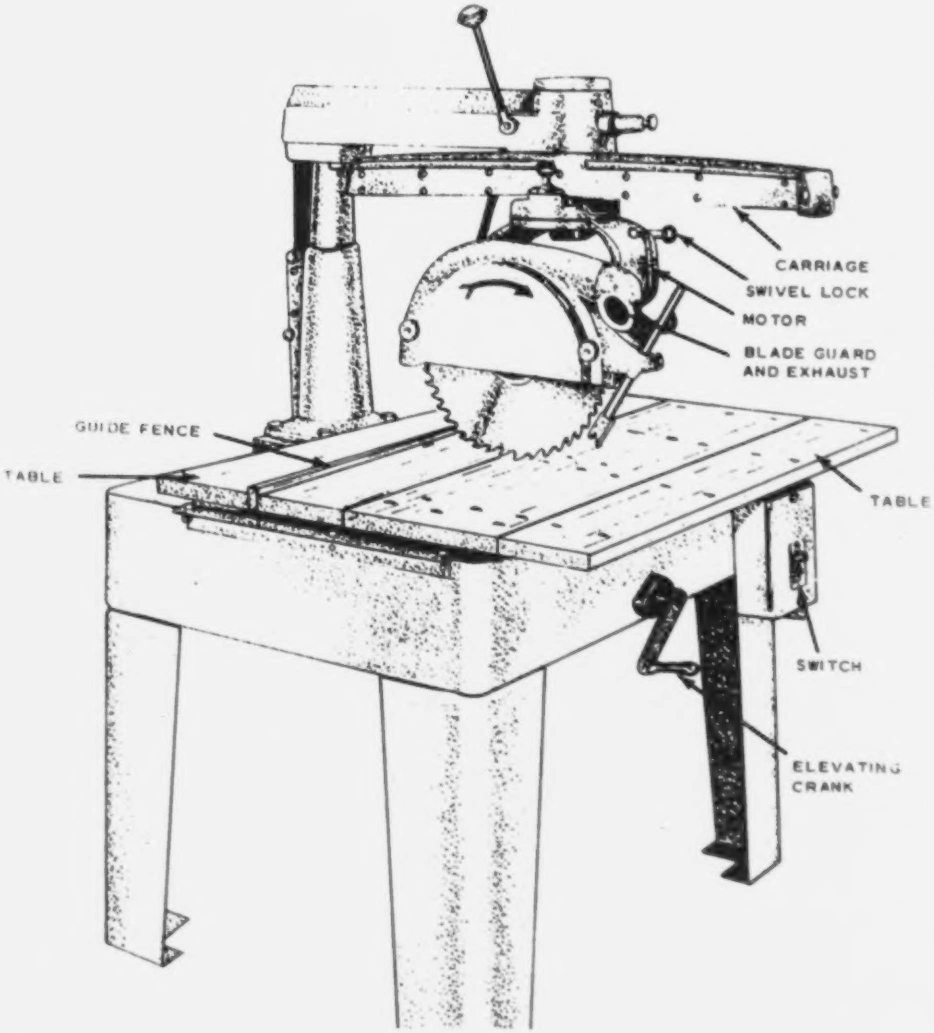
(c) Maintain/repair

1 Change blade when dull

2 Check parts for security

3 Repair or replace damaged electrical cord

c. Radial arm saw


CARRIAGE
SWIVEL LOCK
MOTOR
BLADE GUARD AND EXHAUST
GUIDE FENCE
TABLE
TABLE
SWITCH
ELEVATING CRANK

(1) Preoperation checks

(a) Check blade for sharpness and proper installation

(b) Check saw table for security

(c) Check saw assembly adjustments

(d) Check work area

(2) Maintenance

(a) Clean - Wipe dirt and dust off of exterior

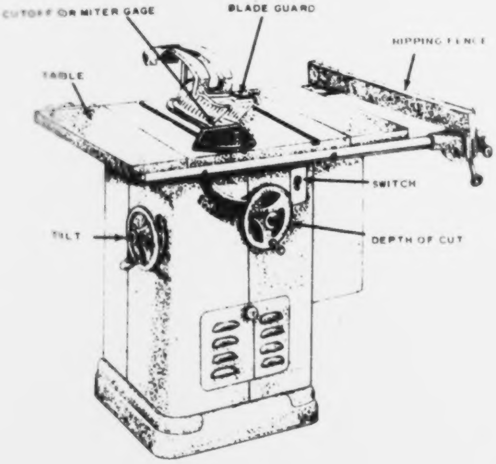
(b) Lubricate - Oil machine as specified by manufacturer

(c) Maintain/repair

1 Keep blade sharp and set

2 Repair or replace damaged parts

d. Table saw


CUTOFF OR MITER GAGE
BLADE GUARD
RIPPING FENCE
TABLE
SWITCH
TILT
DEPTH OF CUT

(1) Preoperation checks

(a) Check blade for sharpness and proper installation

(b) Adjust blade to desired height

(c) Move fence as required

(d) Check guard assembly

(2) Maintenance

(a) Clean - Wipe dirt and dust off exterior

(b) Lubricate - Oil machine as specified by manufacturer

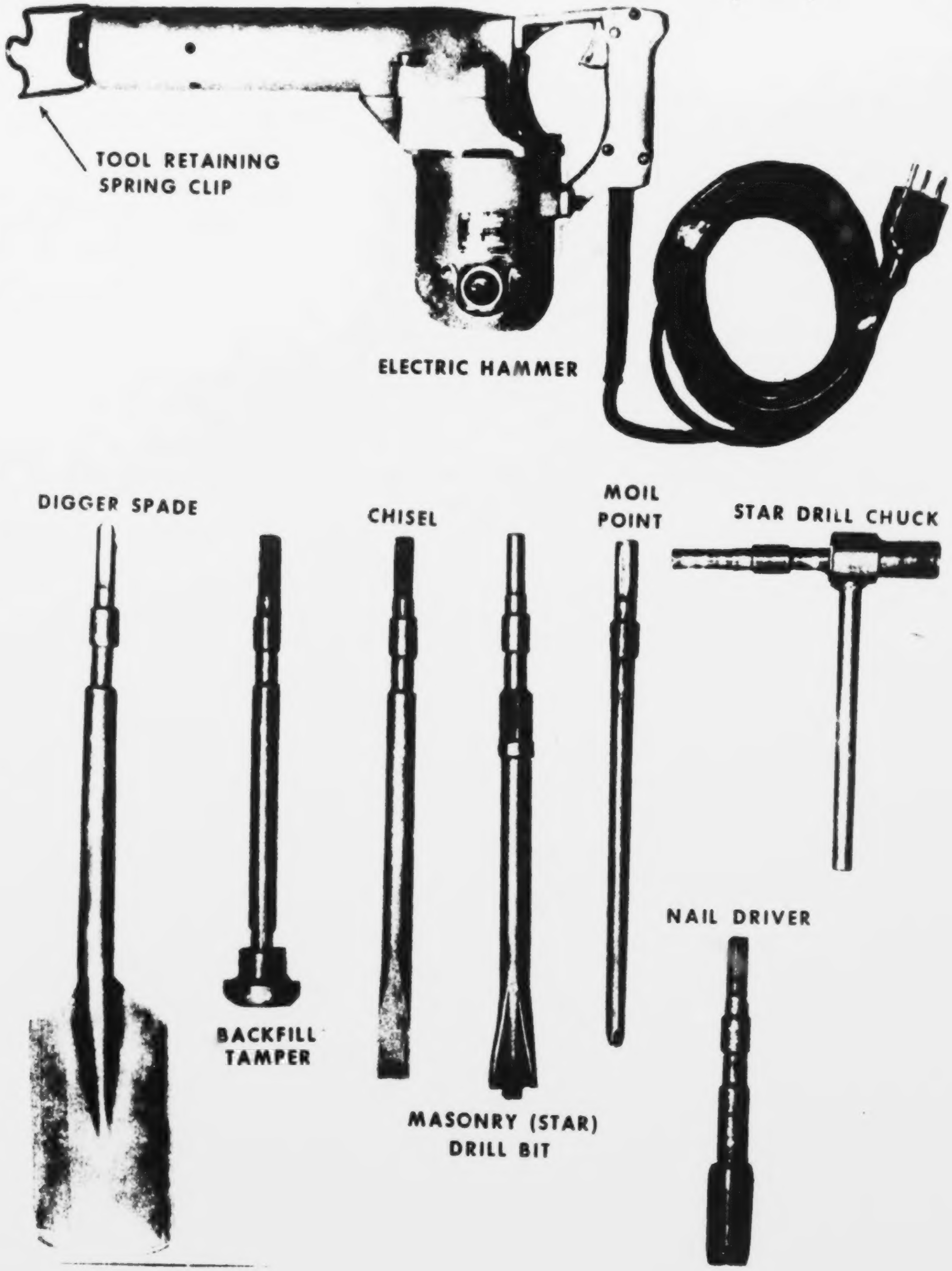
(c) Maintain/repair

1 Keep blade sharp and set

2 Check and tighten parts as required

3 Check V-belt for condition and tension and replace when needed

6. Electric hammer


TOOL RETAINING SPRING CLIP
ELECTRIC HAMMER
DIGGER SPADE
CHISEL
MOIL POINT
STAR DRILL CHUCK
BACKFILL TAMPER
MASONRY (STAR) DRILL BIT
NAIL DRIVER

a. Safety precautions

   (1) Make sure the electric hammer has a 3 prong grounded plug

   (2) Wear goggles

   (3) Do Not operate while standing in water

   (4) Make sure the attachment used is properly secured by the tool retaining springclip

b. Preoperation checks

   (1) Check electrical cord

   (2) Check selector switch

   (3) Check lock chuck

c. Maintenance

   (1) Clean

      (a) Remove dust and dirt from exterior

      (b) Wipe dirt from attachments with clean cloth

   (2) Maintain/repair

      (a) Replace damage attachments

      (b) Check for security of screws and bolts

      (c) Repair or replace damaged electrical cord

MISSION II

PROCEDURE

Working as a member of a team, using instructions and checklists, and exercising safety precautions, select, clean, sharpen, lubricate or maintain masonry tools and equipment. Limited instructor assistance may be provided.

1. Sharpen the cutting edge of either the brick set or a mason's hammer.

   a. List four safety precautions to be observed while performing this task.

      (1) ____________________

      (2) ____________________

      (3) ____________________

      (4) ____________________

   b. Be sure that all of the safety precautions are followed.

2. Dress the edge of a shovel or other masonry material handling tools, and list four safety precautions to be observed while this task is being performed.

   a. ____________________

   b. ____________________

   c. ____________________

   d. ____________________

3. Clean, treat, and store shovel or other masonry material handling tools as directed and list four safety precautions to be observed while this task is performed.

   a. ____________________

   b. ____________________

   c. ____________________

   d. ____________________

4. Remove and replace a hacksaw blade in a hacksaw frame.

MISSION III

PROCEDURE

Use your study guide and/or class notes to complete the following:

1. LEVELS

   a. Levels are used to check ____________ and ____________ alignment.

   b. The mason level is usually ____________ in length and made of aluminum magnesium, or ____________.

   c. A level is probably the most ____________ instrument that a mason uses.

   d. The small, light-weight level that attaches to a cord is called a ____________ ____________.

   e. You should check the condition of the ________ ________ and glass cover of a level, and always ____________ the level after use.

2. MEASURING TOOLS

   a. Standard measuring tools for the mason is a 6 foot ________ ________ and a 10 foot ________ ________.

   b. For measuring distance where a rigid measure is needed, you would use a ________ ________.

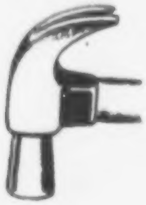
   c. Most of the tapes and rules that a mason uses are graduated to ________ of an inch.

   d. The folding rule should be ____________ when not in use.

   e. If a steel tape gets wet, dry the tape with cloth and ________ ________ before rewinding.

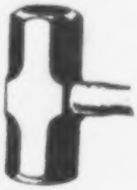
3. HAMMERS

   a. Identify the following items·



(1)

Name: ____________________



(2)

Name: ____________________

b. Match the item with its use or description by placing the correct number in the space provided.

1. Claw hammer
2. Sledge hammer
3. Brick hammer
4. Tile hammer

_____ Used for splitting block

_____ Designed to pull nails

_____ Available in sizes from 2 to 20 pounds

_____ Is lighter in weight than a brick hammer

_____ Available in 13, 16, and 20 ounce sizes

_____ Used for cutting ceramic tile

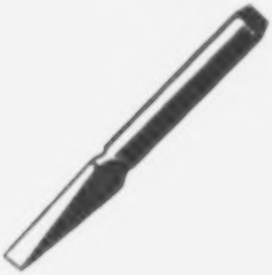
_____ Used to drive heavy spikes

c. Before using a hammer check for a ____________ or ____________ handle.

d. Clean hammers after use and return them to the ____________ - ____________.

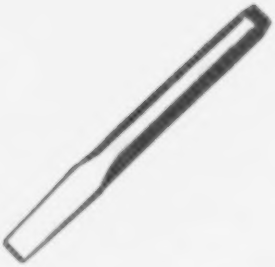
4. CHISELS

a. Identify the following items:



Name: ______________________

(1)



Name: ______________________

(2)

b. Match the item with its use or description by placing the correct number in the space provided.

1. Cape cold chisel
2. Flat cold chisel
3. Round nose cold chisel
4. Diamond point cold chisel
5. Brick set
6. Blocking chisel
7. Woodworkers chisel

________Used to cut block

________Used to cut V-Joints

________Designed to cut sheet metal

________Made to cut grooves, slots and keyways

________Designed to cut and shape wood

________Has a blunt cutting edge

________Has wooden or plastic handle

________Used to cut concave joints

c. Check the cutting edge of a chisel for correct shape and ________________.

d. What should be done to a chisel with a mushroomed end? ________________

____

e. Before chisels are stored apply a ________________________ and protect the cutting edge from ____________________________.

5. TROWELS

a. The trowel is the masons principal ________________ ________________.

b. The 2 main types of trowels are the ____________ ____________ trowel, and the ____________ trowel.

c. The 3 parts of a trowel are the ____________, ____________, and the ________________.

d. Trowels are used to spread and smooth ____________, ____________, and ________________.

e. A trowel should be checked for a ____________ handle and the blade inspected for ____________.

6. EDGERS

a. Edgers are used to round off and ________________ the edge of concrete slabs.

b. Edgers are available for both ____________ and ____________ corners.

c. Edgers should be checked for ____________, damage and loose handles.

7. GROOVERS

a. Groovers are also called ______________ ________________.

b. A groover is used to cut joints in ______________ ______________.

c. Groovers should be checked for _ ___________ cleanliness, and loose handles.

8. JOINTERS

a. Jointers are used to ___________ the surface of mortar joints.

b. Jointers are also called ____________ tools, or ___________ tools.

c. Jointers are used in ____________ and ____________ work.

d. The one piece, all metal type is a ______________ jointer.

e. Horizontal jointers are also called _ ____________ runners or __________ runners.

f. Jointers should be checked for __________, cleanliness and ___________ ___________ if installed.

9. JOINT RAKERS

a. A joint raker is a tool designed to produce a _________ _________ joint.

b. The 2 main types of joint rakers are the ___________ _________ and the ____________ ____________.

c. Joint rakers are checked for rust, damage, and ________________.

10. DARBIES

a. A darby is used to level the surface of ____________, or ___________ the surface of a concrete slab.

b. Darbies are made of ___________, ____________, or _________________.

c A darby should be checked for ________________, and ___________ handle.

11. BRICK TONGS

a. Brick tongs are used to ___________ bricks.

b. Brick tongs can handle about ____________ bricks at one time.

c. Brick tongs are checked for ____________, and the adjuster and lock nut checked for proper ________________.

12. FLOATS

a. Floats are used in finishing to float out ____________ or ____________.

b. Hand floats may be made of _________, ________________, ______________, ____________, or ____________ ____________.

c. Large type floats are called __________ - __________ and are made of __________ or __________.

d. Large floats may have handles that range up to ________ feet long.

e. Floats should be checked for __________, __________, and __________ of the handle.

13. TAMPER

a. Tampers are used to __________ the concrete into a dense mass.

b. A jitterbug is a type of __________ __________.

c. Tampers should be checked for cleanliness, __________, and loose parts.

14. LINES

a. Mason line is usually made of ________ or __________ cord.

b. A masons line is used to keep each course __________ and in __________.

c. Lines are held in place with __________ __________.

d. Line holders that are used to secure the line at corners is called __________ __________.

e. An intermediate line support is called a __________.

f. Mason lines should be checked for __________.

g. Line holders are checked for __________ and __________.

15. PLUMB BOB

a. A plumb bob is used to check that one point is directly __________ another point.

b. A plumb bob is not accurate in __________.

c. Check the plumb bob for condition of the __________.

16. SAWS

a. A crosscut saw is used to cut __________ the grain, and a rip saw is used to cut __________ the grain.

b. After using a saw, always oil the blade with a __________ __________.

c. If rust appears on the blade, remove with a __________ and apply a __________.

d. Rip saw teeth are shaped and filed to cut like ____________________

while the teeth of a crosscut saw like ____________________

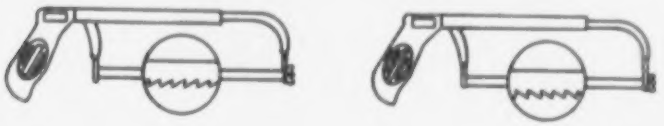
e. The two types of hacksaw frames are:

(1) ____

(2) ____

f. For most sawing jobs, use a hacksaw with ________ teeth per inch.

g. For sawing thin metal, use a hacksaw blade with ______ or ________ teeth per inch.



TC-084

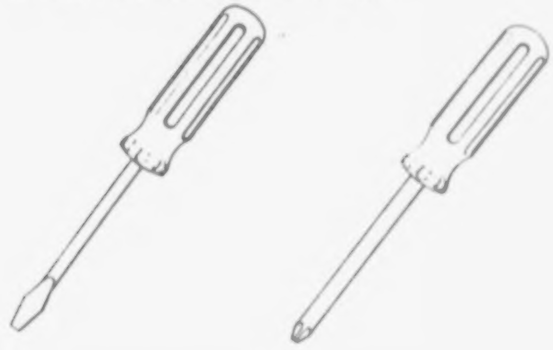
h. In the drawing above, the blade in the hacksaw on the ______________ is installed correctly since it will cut on the ____________________ stroke.

i. When using a hacksaw, there should always be at least ________________

teeth in contact with the metal.

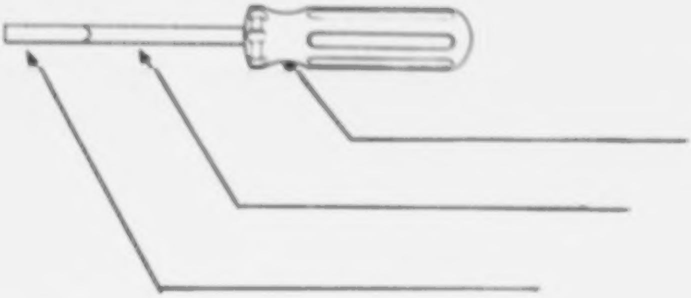
17. SCREWDRIVERS

a. The names of the screwdrivers shown below are:



(1) ________________ (2) ________________

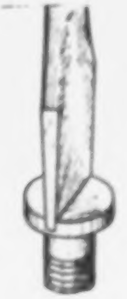
b. The parts of a screwdriver are:



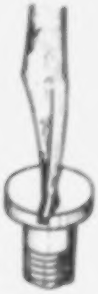
c. The size of a screwdriver is determined by measuring the ________________

________________________________ and the ________________________________.

d.



(1)



(2)

(1) Shows ____

(2) Shows ____

e The tip of a damaged screwdriver can be returned to original shape by

______________________.

f. What is used to smooth a rough handle on a screwdriver? ________________

____

18. FILES

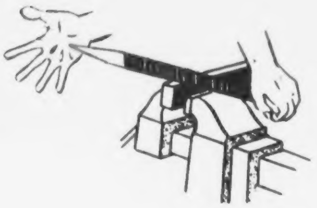
a. Files are used for ________________ and ________________ or removing small amounts of metal.

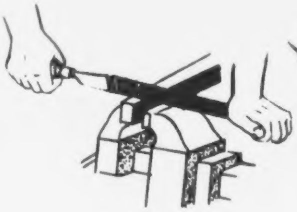
b. Name the five parts of a file

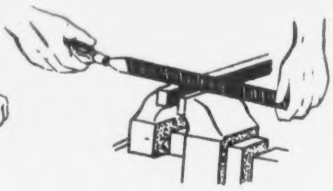
1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

c. Files should never be used without a ______________________.

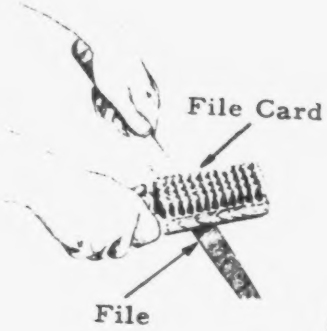
d. Correct use of a file is shown in which drawing? __________

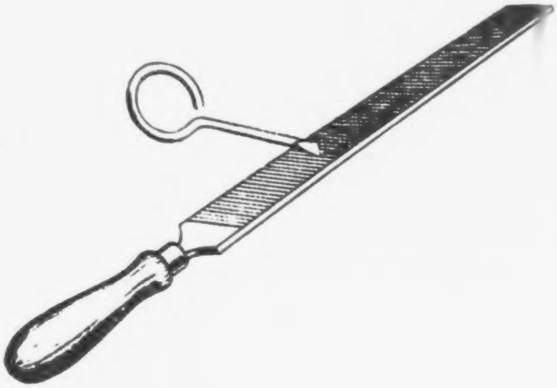

1


2


3

e. Excessive pressure while filing results in ________________ and ________________ of the teeth.

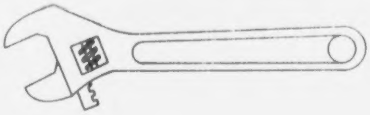




f. The drawing on the left above shows how a file is cleaned with a ________ ______________________________. Metal particles are also removed from a file as shown in the drawing on the right with a ________.

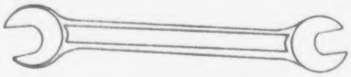
19. WRENCHES

a. Identify and give the purpose of the following tools:



(1) Name: ____________________

(2) Purpose: ______________________________



(1) Name: ____________________

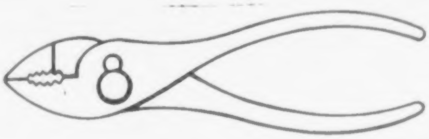
(2) Purpose: ______________________________

b. Coat moving parts of wrenches with a light coat of ____________.

c. Do not use a wrench that is ____________.

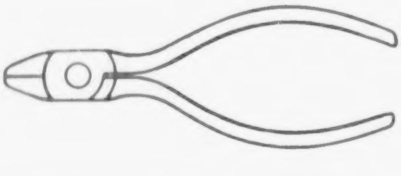
20. PLIERS

a. Identify and give the purpose of each of the following tools:



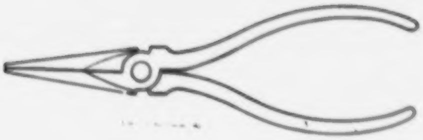
(1) Name: ____________________

(2) Purpose: ______________________________



(1) Name: ____________________

(2) Purpose: ______________________________



(1) Name: ______________________________

(2) Purpose: ____

b. What type of pliers is used to cut away small bits of tile?

____

c. Moving joints of pliers should be ______________________________.

d. Pliers should be checked for cleanliness and __________ __________.

21. ALLEN WRENCHES

a. Allen wrenches are also called ______ __________ wrenches.

b. Allen wrenches are used to turn __________ __________ bolts and screws.

c. Remove rust from allen wrenches with __________ __________.

d. To prevent rust, tools should be given a light coating of __________.

22. CUTTERS

a. Metal shears are also called __________ __________.

b. Metal shears are used for cutting __________ __________ __________.

c. Metal shears are available in __________ blade or __________ blade for making different type cuts.

d. Bolt cutters are used to cut __________, __________, and __________.

e. Metal shears and cutters should be kept __________ and __________.

f. Cutters should check for ____________________.

23. FRAMING SQUARE

a. A framing square is also called a __________ square, a __________ square, or a ______________ square.

b. Framing squares are normally made of __________, __________, or ________.

c. The manufacturers name is on the ________ side of the square.

d. The longer arm of the square is called the __________ or __________.

e. When not in use, lay the square on ______________________________.

f. Apply a light coat of ____________ before storing.

g. Check squares for ___________ and ________________.

24. CONCRETE MIXER

a. Most of the concrete you will use is bought locally and delivered by ________________ _______________ __________________.

b. For small jobs and when ready-mix is not available, concrete is prepared with a ____________________ ______________________.

c. Concrete mixers are used to mix ____________, ___________, and ______________________.

d. Mechanical concrete mixers range in size from about _____ cubic foot to _________ cubic yards.

e. Concrete mixers are usually powered by _________ ___________ or ____________ ______________.

25. CONCRETE SAW

a. Some of the reasons for sawing concrete are:

(1) to provide ______________ _______________.

(2) control ______________________________.

(3) shape _________________________________.

b. Masons use the ____________ ____________ size concrete saw.

c. Small concrete saws may have electric motors, but most are powered by ________________________________.

d. Blades used on concrete saws are usually ____________ discs or __________________ tip blades.

26. MORTAR MIXER

a. Mortar mixers are used to prepare __________ and mix _____________.

b. A mortar mixer is similar to a concrete mixer except that it is usually ____________________.

c. Mortar mixers are powered by a ___________ ___________ or an ____________ _______________.

d. A common size mortar mixer handles about _________ cubic feet.

e. The paddles of the mortar mixer have extensions made of ________________ ______________.

27. TILE SAW

a. The masonry or tile saw is used to cut __________, ____________, ____________ and __________________.

b. Masonry blades range in size from _______ to _________ inches.

c. Blades of masonry saws have tips made of ________________ or industrial ______________________________.

d. You should order the size masonry material required because blades are __________________ and cutting material is _____________ _______________.

28. ELECTRIC SAWS

a. One job that requires the mason to use an electric saw is cutting lumber for __________________.

b. Three common types of electric saws are:

(1) ______________ ______________ saw.

(2) _____________________ saw.

(3) ______________ ________________ saw.

c. The 3 types of saw blades commonly used are the __________, ________________, and ______________________.

29. ELECTRIC HAMMER

a. The portable electric hammer is used as a ____________ or a ______________.

b It has a variety of changeable bits such as ____________, ______________, and ______________________.

PLANNING A MASONRY PROJECT

OBJECTIVE

Given architectural drawings, identify masonry materials used, dimensions and location of given components, by completing at least 70% of the exercises.

EQUIPMENT

	Basis of Issue
SG J3ABR55231 000-I-4	1/student
WB J3ABR55231 000-I-4-P1	1/student
Engineering Drawings	1/student

INSTRUCTIONS

Mission 1

Use your study guide, class notes, and the engineering drawing given to you by your instructor to complete the following:

1. Plot Plans

What information is given in plot plans?

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

f. ____________________

(1) ____________________

(2) ____________________

(3) ____________________

2. Foundation Plans (Use drawing number 25-074/3)

a. K-3- What is the size of the footing? ____________________

b. H-3- What size reinforcement steel is used? ____________________

c. Latrine #4 - What is the size of the concrete slab?

(1) Thickness ______________________

(2) Length ______________________

(3) Width ______________________

3. Framing Plans (Use drawing number 25-074/3)

a. N-3- What is the size of the floor joist? ______________________

What is the center spacing? ______________________

b. K-3- What type of floor covering will be used?

____

c. E-3- What is the size of the blocking? ______________________

4. Floor Plans (Use drawing number 119-58)

a. What is the building dimensions? ______________________

b. How many sets of double doors are there? ______________________

c. What is the width of the sliding door? ______________________

d. What is the width of the double doors? ______________________

(1) East ________________

(2) West ________________

5. Elevations (Use drawing number AW 21-01-03, plate 27)

a. What is the elevation of the kitchen floor? ______________________ ft.

b. What is the height of the ceiling of the dishwashing room?

____

c. Window spacing for court A, what type glass is used?

____

d. Using elevation number 3, what type of materials are used for the facing?

____

6. Selections and details (Drawing number AW 21-01-03, plate 28)

a. Section 2 - What are the different sizes of concrete masonry units used?

(1) ______________________

(2) ______________________

b. Section 2 - Horizontal reinforcement will be tied on ________________ centers.

c. Section 7 - What type of windows are used? ____________________

d. Section 11 - How far apart are weep holes drilled? ____________________

7. Drawing Techniques (Details)

a. ____________________

b. ____________________

c. ____________________

d. ____________________

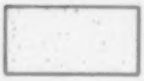
e. ____________________

f. ____________________

8. Symbols

Use your MODERN MASONRY textbook to identify the symbols and fill in the blanks.

a. Symbols

(1)

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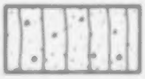
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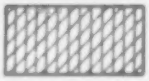
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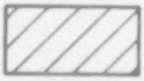
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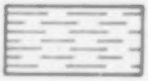
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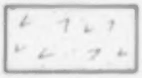
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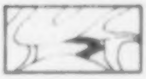
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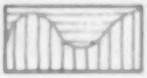
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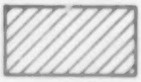
(9)

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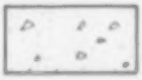
(10)

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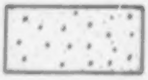
(11)

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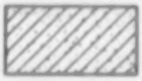
(12)

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PREPARING CONCRETE MIXTURES

OBJECTIVE

Working as a member of a team, and using materials provided, measure, mix and perform field tests for consistency of three concrete mixtures. Instructor assistance may be provided for most parts of the task

EQUIPMENT

	Basis of Issue
SG J3ABR55231 000-I-5	1/1 student
WB J3ABR55231 000-I-5-P1	1/1 student
Slump cone and rod	1/2 students
Wheelbarrow	1/4 students
Shovel	1/4 students
Hoe	1/4 students

MISSION I

PROCEDURE

Working as a member of a team, and using materials provided, measure, mix and perform field tests for consistency of three concrete mixtures. Instructor assistance may be provided for most parts of the task.

1. Students will mix three batches of concrete, using the following mixes:

   a. Cement - one shovel

   b. Sand - two shovels

   c. Aggregate - three shovels

   d. Water - added in proper ratio to make batch no. one, then use aggregate to adjust mix for remaining batches.

2. The students will then perform a slump test on each batch. Each batch must be within the limits as set forth.

   a. Batch number one - 4 to 6 in. slump

   b. Batch number two - 2 to 4 in. slump

   c. Batch number three - 0 to 2 in. slump

3. The steps for doing the slump test are:

   a. Fill the slump cone one-third full of concrete.

   b. Rod the concrete 25 times with pointed rod.

   c. Fill the slump cone two-thirds full of concrete.

   d. Rod the concrete 25 times with pointed rod.

   e. Fill the slump cone full of concrete.

   f. Rod the concrete 25 times with pointed rod and smooth top of cone.

   g. Remove slump cone from the concrete.

   h. Place slump cone near concrete; place the pointed rod across top of cone and concrete. Using a ruler, measure the distance between the rod and top of concrete; this will be the slump test.

Record results of the slump test in the blanks provided below.

1. Batch number 1, very wet sand ______________________________

2. Batch number 2, wet sand ______________________________

3. Batch number 3, damp sand ______________________________

CONSTRUCTION LAYOUT

OBJECTIVES

Working as a member of a team, using materials, area, hand tools, and dimensions provided, layout a site for construction of a concrete slab. Layout must be within ± 1/4 inch of tolerance. Instructor assistance may be provided on most parts of the task.

Using tools provided, prepare an area for a concrete form. The completed area must be smooth, compacted, and ready for construction of the form. Instructor assistance may be provided on most parts of the task.

EQUIPMENT

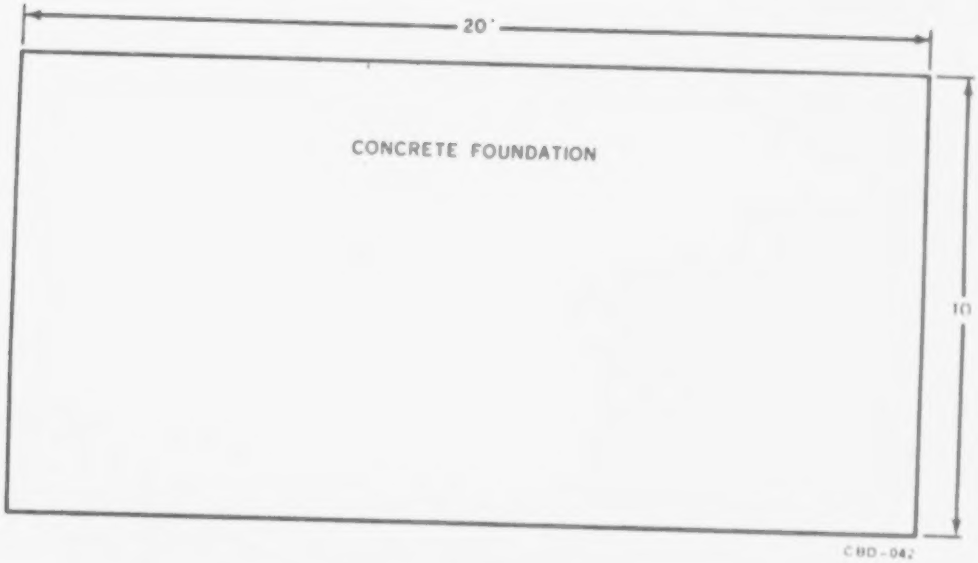
	Basis of Issue
SG J3ABR55231 000-I-6	1/student
WB J3ABR 55231 000-I-6-P1	1/student
50-foot steel tape	1/6 students
2x4 and 1x6 lumber	1/4 students
Sledge Hammer	1/6 students
Electric Saw	1/12 students
Water Level	1/12 students
Builders Level	1/6 students
Hammer	1/4 students
Nails	1/student
Tamper	1/12 students
Shovel (round point)	1/3 students
Shovel (square)	1/3 students
Wheelbarrows	1/3 students
Rake	1/3 students
Gravel	1/6 students
Layout Line	1/6 students
Masons Handtools	1/student

MISSION I

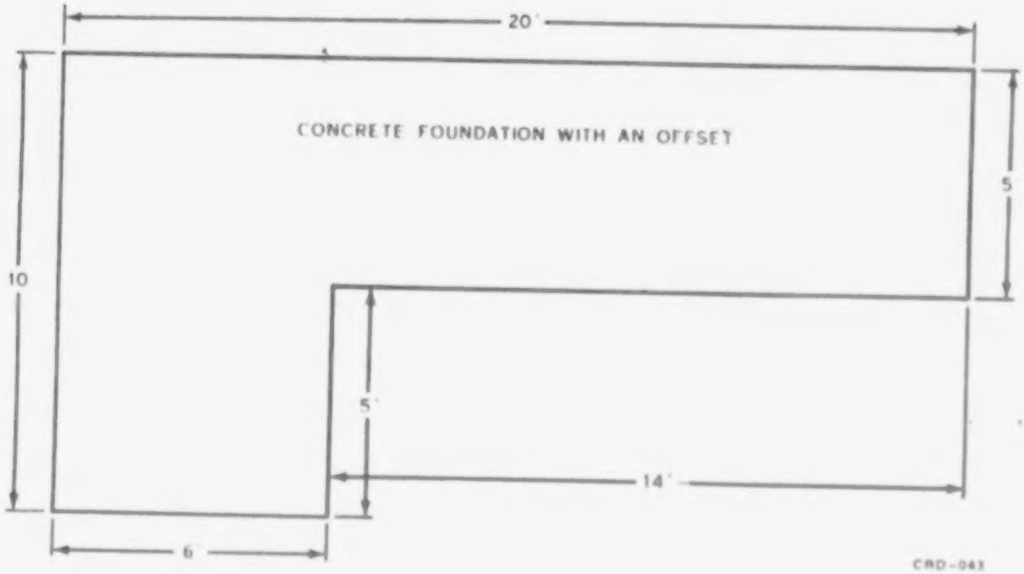
PROCEDURE

Working as a member of a team, using materials, area, hand tools, and dimensions provided, layout a site for construction of a concrete slab. Layout must be within ± 1/4 inch of tolerance. Instructor assistance may be provided on most parts of the task.

1. Procure necessary tools and equipment.
2. Go to the area designated by the instructor.
3. Lay out a rectangular building. (See rectangular building drawing)
4. Set and square the hub stakes. Use the 6-8-10 method for first setting the stakes and then use the diagonal checking method once all of the stakes are set.
5. Set and level the batter boards.
6. String the layout lines. Use a plumb bob or a level to establish where the string lines meet.
7. Cut a kerf in the top of the batter board to hold the layout lines once the position of the line is determined.
8. If time permits follow the same procedures to layout a building with an offset or a U shaped building (See drawings).
9. Have the instructor check your work.



Rectangular Building



Building with Offset

MISSION II

PROCEDURE

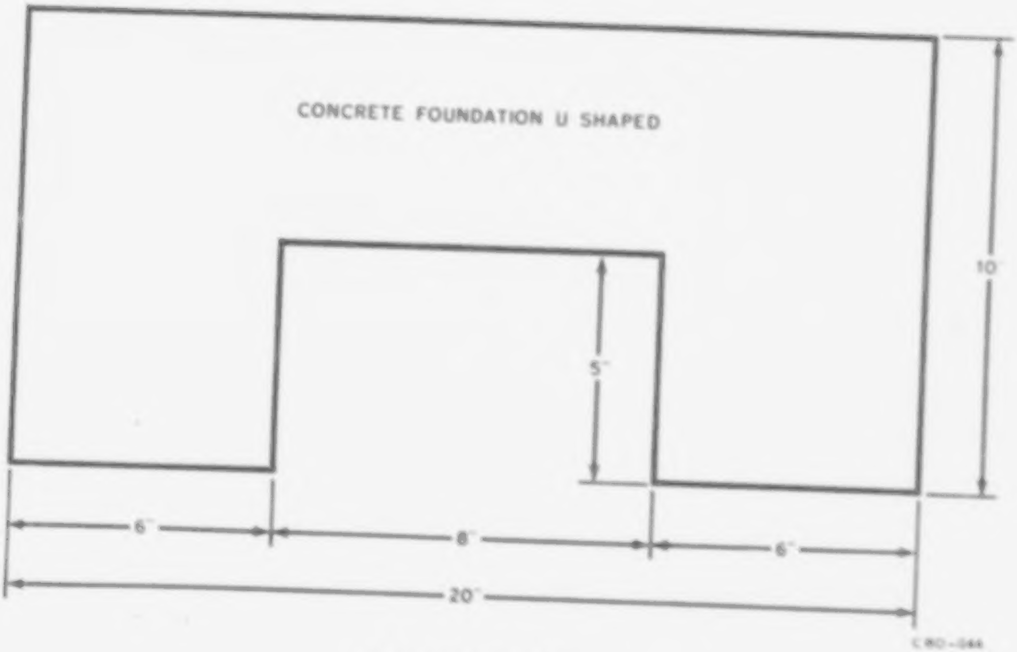
Using tools provided, prepare an area for a concrete form. The completed area must be smooth, compacted, and ready for construction of the form. Instructor assistance may be provided on most parts of the task.

1. Procure the necessary tools and equipment.
2. Go to the area designated by the instructor.
3. Prepare an area for construction of the forms.
   a. Remove all vegetation and topsoil as necessary to set the forms and pour the concrete.
   b. Check the subgrade for soft or hard spots.

c. Compact the loose soil until firmly packed.

(1) Fill any low areas with backfill

4. Have the instructor check your work.


CONCRETE FOUNDATION U SHAPED
10'
5'
6'
8'
6'
20'
C80-044

U-Shaped Building

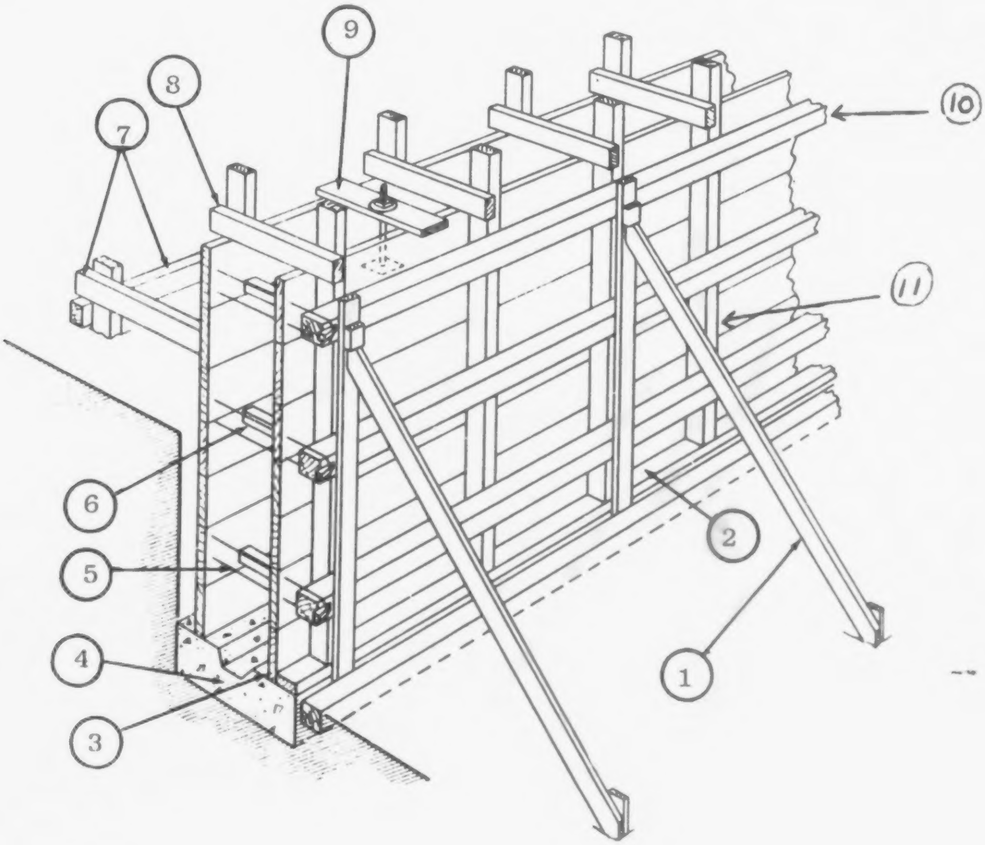
BUILDING FORMS FOR CONCRETE

OBJECTIVE

Working as a member of a team, and using information and tools provided, build a form for concrete, with instructor assistance. The form must comply with the given instructions and be ready to receive concrete mixture.

EQUIPMENT

	Basis of Issue
SG J3ABR55231 000-I-7	1/student
WB J3ABR55231 000-I-7-P1	1/student
Shovels	1/3 students
Sledge Hammer	1/3 students
50' Steel Tape	1/6 students
Layout Line	1/6 students
Lumber for Forms	1/6 students
Mason Handtools	1/student



PROCEDURE

Mission 1

Using your textbook MODERN MASONRY, identify the parts of the wall form as shown on page 40. All parts must be identified correctly.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________
10. ____________________
11. ____________________

Mission 2

NOTE: In this area you will construct a form for a concrete slab. The size and location of the form will be given to you by the instructor.

1. Construct a slab form. Follow the instructions given you by the instructor.
2. Use the following checklist to insure the slab form is properly constructed.
    1. Is the form in the correct place?
    2. Is the form of the correct size and shape?
    3. Are there enough braces and stakes?
    4. Is the form strong enough?
    5. Are all the joints tight?
    6. Are the forms level?
    7. Are the interior parts of the forms oiled?
    8. If there are anchor bolts required, are they placed properly?
    9. Are forms square and perpendicular where required?

INSTALLING REINFORCEMENT MATERIAL

OBJECTIVE

Working as a member of a team, exercising safety precautions, and using masonry tools and equipment, prepare, and install reinforcement into concrete forms. Instructor assistance may be provided for most parts of the task.

Using information provided, identify the types and uses of concrete anchor bolts and fastening devices.

EQUIPMENT

	Basis of Issue
SG J3ABR55231 000-I-8	1/student
WB J3ABR55231 000-I-8-P1	1/student
Bending Table	1/6 students
Bolt Cutter	1/3 students
Pliers	1/3 students
Six-Foot Rule	1/3 students
Steel Mesh	
Steel Bars	
Soft Iron Wire	

PROCEDURE

Mission 1

NOTE: Before accomplishing the following projects, obtain necessary specifications from your instructor.

1. Installing Wire Mesh in a Slab Form

A. Estimate the amount of steel wire mesh you will need.

B. Unroll wire mesh and cut to length with bolt cutters while observing safety precautions.

C. Place wire mesh in forms.

D. Check for correct overlap (minimum 6 inches)

E. Install supports, spacers, spacer blocks or other devices as directed.

F. Have instructor check your work when completed.

Installing Steel Bars in a Form

Install wooden spacer blocks at the top and bottom of forms as necessary.

Measure, cut, bend, and install vertical bars, as required.

Measure, cut, bend and install horizontal bars as required tying them to the vertical bars as the work progresses and as directed by your instructor.

Check for correct bar spacing.

Have your instructor check reinforcement installation when complete.

PLACING CONCRETE FOR A SLAB

OBJECTIVE

Working as a member of a team, exercising safety precautions, and using masonry tools and equipment, measure, mix, perform a field test, place, consolidate and finish the concrete project. Concrete must be ready for the curing process. Instructor assistance may be provided for most parts of the project.

EQUIPMENT

	Basis of Issue
SG J3ABR55231 000-I-9	1/student
WB J3ABR55231 000-I-9-P1	1/student
Concrete Mixer (6 cu ft capacity)	1/6 students
Water Hose (if required)	
Screed Board	1/6 students
Wood Floats	1/3 students
Steel Trowels	1/3 students
Edging Board	1/3 students
Burlap or Curing Compound (as prescribed)	
Portland Cement (amount required)	
Fine Aggregate (amount required)	
Coarse Aggregate (amount required)	
Water (as required)	

PROCEDURE

MISSION I

1. Using the following inspection guide perform preoperational and operational safety checks on the mixer.

a. Preoperational inspection

(1) __________ Check for safety chain connection to hopper.

(2) __________ Remove towing tong.

(3) __________ Check wheels on mixer for secure emplacement.

(4) __________ Check engine oil supply for full condition, add oil if needed.

(5) __________ Check fuel supply and service if needed. FOLLOW ESTABLISHED SAFE SERVICING PROCEDURES

(6) __________ Check lift cable for proper wind on pulley.

b. Operational safety guide.

(1) ____________ Clear everyone from hopper travel.

(2) ____________ Start mixer engine.

(3) ____________ Engage clutch.

(4) ____________ Insure that everyone is clear of the hopper travel.

(5) ____________ Disconnect safety chain.

(6) ____________ Release hopper to full down position slowly.

(7) ____________ Observe cable unwinding (allow to unwind slowly).

(8) ____________ Raise hopper until hopper knocks emptying concrete materials into mixing drum.

Mission 2

1. Following these instructions measure, and mix the concrete for the project

a. Pour approximately 10 percent of the mixing water into the mixer drum.

b. Load dry materials into the skip in the following sequence:

(1) Gravel

(2) Portland Cement

(3) Sand

c. Pour dry materials into drum while uniformly adding 80 percent of the mixing water.

d. After all ingredients are in the mixer, add the remaining 10 percent of water.

e. Mix for a minimum of 1 minute for mixtures up to 1 cubic yard. Add 15 seconds mixing time for each additional ½ cubic yard.

f. Measure the mixing time from the time all materials are in the mixer.

Mission 3

1. Perform a field test for consistency, transport, and place the concrete
    a. Extract concrete from mixer into wheelbarrows
    b. Perform a slump test
        (1) One after the first batch is mixed (adjust mix as necessary)
        (2) After half the project is completed
        (3) During the last couple mixes to be used
    c. Transport concrete to formed area
    d. Consolidate concrete and forms with shovels, jitterbugs, etc., as the concrete is being placed
    e. Using screed board, bring concrete to proper grade or elevation
    f. Float the concrete, being careful not to overwork it, bringing up too much paste

Mission 4

1. Following the outlined procedures finish the concrete project
    a. Allow concrete to hydrate and set until ready to trowel.
    b. Trowel concrete using method demonstrated by your instructor.
    c. Use edging tool and edge concrete.
    d. Proper curing procedures will be covered in the last part of the day. See WB J3ABR55231 000-I-10-P1 curing concrete slabs.
2. Postoperation and Cleanup:
    a. Clean mixer and all equipment. Have the instructor check your work.
    b. Perform postoperational safety check on mixer.
        (1) ________ Raise hopper.
        (2) ________ Connect safety chain.
        (3) ________ Connect towing tongue (if mixer is towed).
        (4) ________ Turn switch OFF.
    c. Return mixer, and all other tools and equipment to designated storage areas.

CURING CONCRETE SLABS

OBJECTIVE

Using given procedures, and with instructor assistance for most parts of the task, apply the material necessary to protect the concrete from extremes of weather and to effect a satisfactory cure of concrete slabs and structures.

EQUIPMENT

	Basis of Issue
SG J3ABR55231 000-I-10	1/student
WB J3ABR55231 000-I-10-P1	1/student
Sand (as required)	
Polyethylene Sheets or Waterproof Paper	1/12 students
Fabric	1/12 students

PROCEDURE

Mission I

The student will apply coverings to fresh concrete to obtain proper curing. The coverings will be applied as directed by the instructor.

Water

1. After concrete has hardened for a few hours, wet concrete surface thoroughly with water.
2. Check surface frequently to make sure that it stays wet.

Sand

1. Spread concrete surface with a layer of sand.
2. Wet sand with water.
3. Keep sand wet to ensure curing.

Fabric

1. Place fabric over slab.
2. Wet fabric with water.
3. Keep fabric wet to ensure curing.

Waterproof Paper or Polyethylene Sheets

1. Moisten concrete with water.
2. Apply waterproof paper or polyethylene sheets.
3. Overlap edges of paper or polyethylene to keep moisture under the coverings.

REMOVE FORMS AND FINISHING CONCRETE SURFACES

OBJECTIVE

Working as a member of a team, exercising safety precautions, and using masonry tools and equipment, remove, clean and store forms, and make patches as necessary to finish the concrete. Instructor assistance may be provided for most parts of the task.

EQUIPMENT

	Basis of Issue
SG J3ABR55231 000-I-11	1/student
WB J3ABR55231 000-I-11-P1	1/student
Mason Handtools	1/student
Wheelbarrows	1/6 students
Shovel	1/6 students
Hoe	1/6 students
Cement	1/6 students
Sand	1/6 students
Gravel	1/6 students

PROCEDURES

Mission 1

When you have completed this mission, you will be able to remove concrete forms; use a carborundum stone to clean and finish a concrete surface; fill surface voids; and clean, oil, and store forms.

Removing Forms

1. Remove stakes and braces.

2. Move forms away from concrete. Be careful not to damage concrete surfaces.

3. Move forms away from the immediate work area.

Cleaning Concrete Surfaces

As directed by the instructor, wet a specified area and remove excess concrete and stains with a carborundum stone.

Filling Voids

1. As directed by your instructor, prepare a cement and sand grout and fill voids.

2. As directed by your instructor, prepare a cement and sand slurry paste and fill voids.

   a. Apply the slurry paste with a brush.

   b. Rub the surface with a sponge float to insure filling of all holes.

c. After the surface has dried, rub the surface with burlap to remove excess slurry paste.

Cleaning, Oiling and Storing Forms

1. Clean form surfaces with a stiff wire brush.
2. Remove nails as required.
3. Apply a light coat of oil to the form face.
4. Stack the forms in their order of erection or as directed by your instructor.

REPAIRING DAMAGED CONCRETE

OBJECTIVE

Using masonry tools and equipment, and exercising safety precautions, cut, break or drill out a section of concrete and repair the area to match the existing concrete. Instructor assistance may be provided for most parts of the task.

EQUIPMENT

	Basis of Issue
SG J3ABR55231 000-I-11	1/student
WB J3ABR55231 000-I-11-P2	1/student
Air Compressor	1/12 students
Jackhammer	1/12 students
Concrete Saw	1/12 students
Electric Hammer	1/12 students
Concrete Mixer	1/12 students
Wheelbarrow	1/6 students
Vibrator Tamper	1/12 students
Shovels	1/2 students
Sledgehammer	1/6 students
2 X 4 lumber (as required)	
Nails (as required)	
Electric Power Saw	1/6 students
Mason Handtools	1/student
Bolt Cutter	1/6 students
Hacksaw	1/6 students
Re-bar Cutter	1/12 students

PROCEDURE

Mission I

You will inspect and remove a damaged section of concrete designated by your instructor. Prepare the designated area for repair, following the outlined procedures:

1. Inspect defective concrete area.

2. Determine the portion of concrete which must be removed.

3. Air Compressor: Operational Procedures.

    a. Safety Precautions

        (1) Remove all jewelry.

(2) Secure loose hose before starting.

(3) Open service valves before starting.

(4) Stay clear of air blast.

(5) Keep close surveillance of air pressure gauge.

(6) Goggles will be worn when using attachments with air compressor.

b. Preoperational Check

(1) Set unit on level ground.

(2) Check level of crankcase oil and compressor oil.

(3) Check level of fuel and radiator coolant.

(4) Pull out idle control cable.

(5) Press starter button, release when engine starts.

NOTE: If engine fails to start within 30 seconds, stop and wait a short period of time.

(6) Close drain valve on pressure tank.

c. Operational Check

(1) Operate engine at idle until engine temperature reaches operating range of 120°F. Push in idle control cable.

(2) Maintain minimum air pressure of 110 p.s.i. during operation

d. Postoperational Check

(1) Close service valves and run 5 minutes before shutdown.

(2) Stop engine by pulling stop cable.

(3) Open drain valve on pressure tank.

(4) Clean and service compressor before storage.

4. Jackhammer: Operational Procedures

a. Wear safety goggles and gloves.

b. Check to ensure oil is on connection end of bit and in the piston chamber.

c. Connect air hose and secure with safety wire.

d. Proceed to operate safely.

5. Concrete saw: Operation Procedures

   a. Safety Precautions

      (1) Keep hands and feet away from saw blade while in operation.

      (2) Wear goggles while operating saw.

      (3) Remove all jewelry.

      (4) Sweep area before sawing.

   b. Preoperational Check

      (1) Follow manufacturers specifications

      (2) Check engine oil/gas level

   c. Operational Check

      (1) Set blade guard

      (2) Start engine

   d. Postoperational Check

      (1) Shut off engine

      (2) Visually inspect saw

      (3) Clean and service as required

6. Methods of removing defective or damaged concrete

   a. Cut damaged area perimeter out with concrete saw.

   b. Break up damaged concrete area using jackhammer. Electric hammer, sledge hammer and other tools as required.

   c. Remove debris using shovels and wheelbarrows.

   d. Compact subgrade with vibrations tamper.

Mission 2

You will mix, place, finish and cure the concrete for the damaged area that was previously removed.

1. Methods of preparing subgrade edge of old slab

a. Brush edge of existing slab free of all debris and dust.

b. Wet subgrade with water.

c. Brush edges of existing slab with a bonding agent.

2. Reinforcement Steel Placement

a. Secure rebar to existing pad mechanically and use chairs or supports to keep rebar from touching ground.

b. Expanded wire mesh can be used for thin slab construction reinforcement.

c. Follow your instructors direction on reinforcement requirements for your specific project.

3. Concrete Mixture. Concrete Mixer Operating Procedures:

a. Safety Precautions

(1) Remove all jewelry.

(2) Check the safety chain holding the hopper in the up position.

(3) Keep all personnel clear of the machine while in operation.

(4) Try to stay upwind from concrete mixing to avoid breathing soil and cement dust.

b. Preoperational Procedures

(1) Follow manufacturer's specifications and operating procedures.

(2) Remove towing bar.

(3) Check wheels.

(4) Check engine oil.

(5) Check fuel.

(6) Check lift cables.

c. Operating Procedures

(1) Clear all personnel away from hopper.

(2) Ensure clutch is disengaged.

(3) Start engine.

(4) Engage clutch to rotate drum.

(5) Lower hopper to full down position slowly.

(6) Observe cable unwinding off spool.

(7) Fill hopper with proper materials.

(8) Raise hopper until it hits automatic shaker emptying materials into the rotating drum.

(9) Mix no less than one minute.

(10) Dispense concrete from drum.

d. Postoperating Procedures

(1) Raise hopper.

(2) Connect hopper safety chain.

(3) Turn off engine.

(4) Connect towing bar.

(5) Clean and service mixer as required.

4. Concrete Area Repair Procedure

a. Mix, place, and consolidate concrete in area to be patched

b. Screed off concrete to match existing area

c. Finish concrete with wooden floats and steel trowel to match existing concrete area or slab. Edge and groove as necessary.

d. Protect patched area from elements.

e. Cure patched area as directed by your instructor.

J3ABR55231 000-II-1 thru 4

TECHNICAL TRAINING

Masonry Specialist

BLOCK AND BRICK CONSTRUCTION

May 1983

USAF TECHNICAL TRAINING SCHOOL
3770 Technical Training Group
Sheppard Air Force Base, Texas 76311

Designed for ATC Course Use RGL: 9.1

DO NOT USE ON THE JOB

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Supersedes SGs J3ABR55231 000-II-1 thru 4, November 1981

3770 Technical Training Group
Sheppard Air Force Base, Texas

SG J3ABR55231 000-II-1
May 1983

CUTTING MASONRY

OBJECTIVE

Using masonry tools and equipment provided and exercising safety precautions, cut and shape bricks and block to sizes and shapes specified. Instructor assistance may be provided for most parts of the task.

INTRODUCTION

One of man's earliest developments was his use of masonry. As early man started developing, he discovered that he could use rocks and stones for tools, weapons, and shelter. The first shelter was a pile of rocks to keep wild animals and enemies out of his cave. Later he learned that mud packed between the rocks would keep out the wind and cold. Since that time the variety of masonry materials available for use in building has greatly increased, but it is still basically mud and rock in some form or another.

INFORMATION:

Assignment (Day 6)

Read and study Chapter 1, pages 22-27, "Hollow Masonry Units" and Chapter 2, pages 37-48 in textbook, Modern Masonry, Goodheart-Wilcox, Inc., and answer the questions at the end of Chapter 2.

CUTTING AND SHAPING MASONRY

To meet all of the specifications that are set by the architect or the construction engineer, it may require that some of the masonry be cut to fit in a specified area. The specifications may also call for a hole to be cut into the masonry. To cut and shape masonry you need a variety of tools to do a good job. The tools are chisels, hammers, trowels, and a masonry saw. The masonry saw will give you the best cut and should be used if the cut edge is to be visible in the wall surface. A trowel can be used if the cut edge is to be visible in the wall surface. A trowel can be used by the mason to quickly cut a brick to a particular size without the mason stopping his work. Using a trowel in such a manner should be confined to soft brick, and not used on concrete block.

All the types of chisels that are used in masonry work must be used with a hammer. The most common hammers used by a mason for brick and block work are a brick hammer and a 2 pound hammer. A brick hammer is used mostly to cut, shape, and trim brick and block, and the 2 pound hammer is used with a chisel to cut the masonry into the size units needed. A brick set is used to cut brick to a specified length. A blocking chisel is used to cut block. Using a brick set or blocking chisel is the most accurate method for cutting any masonry when there is no available power source to operate a masonry saw. Sometimes electrical wiring is run on the inside of a block, or structural tile wall and requires that a hole be cut in the wall for an outlet box or a wall switch. The tools to cut this hole are a small cold chisel and a hammer.

SUMMARY

There are many kinds of construction done with concrete materials; therefore, there are different types, shapes, and sizes of concrete blocks, and structural tile to meet the various construction requirements. The selection of the proper blocks is a problem of the architect or the structural engineer. It is your responsibility to know the various types so that you can be sure to use the proper block as shown in the blueprints and specifications. It is also important for you to know how to cut the masonry and what tools to use.

QUESTIONS

1. What are the two groups that hollow clay tile is separated into?
2. Structural tile can be positioned so the cells are _______________.
3. What are the two grades of load bearing structural tile?
4. Structural facing tile covers two broad groups, what are they?
5. What size mortar joint is used for structural facing tile?
6. What is used to cut a brick if the cut surface is to be exposed?
7. What tool is used to cut and shape a concrete block?

CONCRETE BLOCK CONSTRUCTION

OBJECTIVE

Using instructions, tools, and materials, layout a site for a concrete block project. The site must be ready for construction of a concrete block corner. Instructor assistance may be provided for most parts of the task.

Working as a member of a team, and using masonry tools and concrete blocks, prepare mortar and construct a corner for a masonry project. The finished work must be within 1/4 inch of proper height and 1/4 inch of plumb. Instructor assistance may be provided for most parts of the task.

Working as a member of a team, and using tools and equipment provided, construct a block wall for a masonry project. The finished work must be within 1/4 inch of proper height and 1/4 inch of plumb. Instructor assistance may be provided for most parts of the task.

INTRODUCTION

No construction material has developed so rapidly over the past 25 years as concrete blocks. The introduction of new materials and improved methods of manufacturing has created an immense market for these units.

It is estimated that approximately 50 percent of exterior walls today are constructed of concrete block units. The use of high production machinery, capable of making up to a thousand block per hour, along with new materials, has increased the demand for their usage. Block and tile are popular because they are easy to handle, easy to lay, and are economical. A concrete block wall can be constructed in much less time than other construction methods. It is very durable, light in weight, ratproof, fireproof, rustproof, and termite proof and is not damaged when in contact with water or chemicals. In this portion of the study guide we will look at the types of concrete blocks and structural tile, and at the techniques of laying concrete block.

INFORMATION

Assignment for Day 7

Read and study Chapter 8, pages 116-118 (Laying Conc[illegible]ck to procedure No. 8 under Laying a Concrete Block Wall) in textbo[illegible]dern Masonry, Goodheart-Wilcox, Inc. Read and study this study guide thru La[illegible]ng to the Line and answer questions 1-7 at the end of the study guide.

Assignment for Day 8

Read and study Chapter 4, "Mortar", pages 59-62 in textb[illegible]k, Modern Carpentry, Goodheart-Wilcox, Inc., and answer the questions. Re[illegible]d and study the study guide from Laying to a Line thru Tooling the Mortar Joints and answer questions 8-14 at the end of the study guide.

Assignment for Day 9

Read and study Chapter 5, "Masonry Anchors, Tiles and Joint Reinforcement", pages 63-67, Chapter 8, pages 118-122, Procedure No. 8 thru Anchorage to Masonry Walls and answer the questions.

Concrete blocks are made by mixing portland cement with water and such materials as sand, pebbles, crushed stone, cinders, slag, burned shale or clay, or many other types of aggregates. Structural tiles are composed of clay and fired in an oven, much the same way as brick.

Concrete Block. Concrete blocks are formed into various structural units and are available in lightweight and heavyweight units. The heavyweight units are usually made from sand, gravel, slag, and crushed stone. The lightweight units are made from shale, coal cinders, clay or slag, and other lightweight aggregates.

Concrete units are made in various shapes and sizes to fit different needs. Unit sizes are usually determined by their nominal dimensions. In other words, a unit measuring 7 5/8 inches wide, 7 5/8 inches high, and 15 5/8 inches long is considered 8 X 8 X 16 inches. When this particular unit is placed in a wall (blueprint specification: 3/8-inch mortar joints) it will fit a space 7 5/8 inches wide, 8 inches high, and 16 inches long. Various shapes and sizes are illustrated in Figure 1.

The decision to use heavyweight or lightweight units is determined by the requirements of the structure under consideration.

Some of the factors that must be considered are (a) whether they are used for interior or exterior wall, (b) whether they are load bearing or nonload bearing, (c) the texture or finish desired, and (d) the cost.

Heavyweight units are normally required in exterior walls to lessen the possibility of absorbing water. Heavyweight units are also required for load bearing walls. The main advantage of lightweight units are that they are cheaper and easier to handle. Therefore, they are faster to lay. The texture of lightweight units is also a desirable feature.

Clay Tile. Structural clay tile are popular because of their low cost. They are very economical and are often used to back up brick walls.

Figure 2 shows one type of clay tile that is used to backup brickwork. Figure 3 illustrates how they are used for this purpose. The tile's rough surface is designed so that it can be plastered direct by first applying dampproof materials. Another type of tile has a single glazed face or a two faced (glazed on both sides). This type (glazed) is used if the wall is not to be plastered and for sanitary purposes in dairies, hospitals and latrines.

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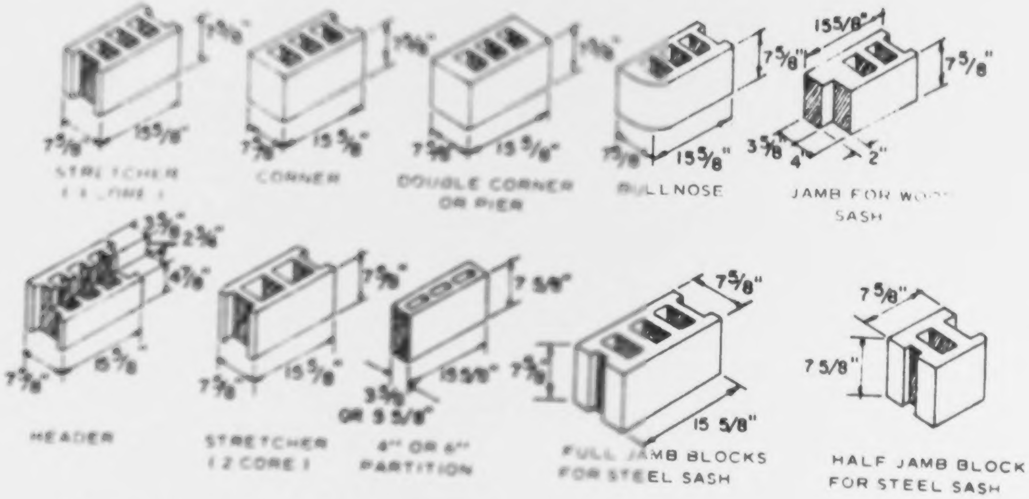

7 5/8"
15 5/8"
STRETCHER
(3 CORE)
CORNER
DOUBLE CORNER
OR PIER
BULLNOSE
JAMB FOR WOOD
SASH
3 5/8"
2 3/8"
4 7/8"
HEADER
STRETCHER
(2 CORE)
3 5/8"
OR 5 5/8"
4" OR 6"
PARTITION
FULL JAMB BLOCKS
FOR STEEL SASH
HALF JAMB BLOCK
FOR STEEL SASH
4"
2"

Figure 1. Sizes of Concrete Block

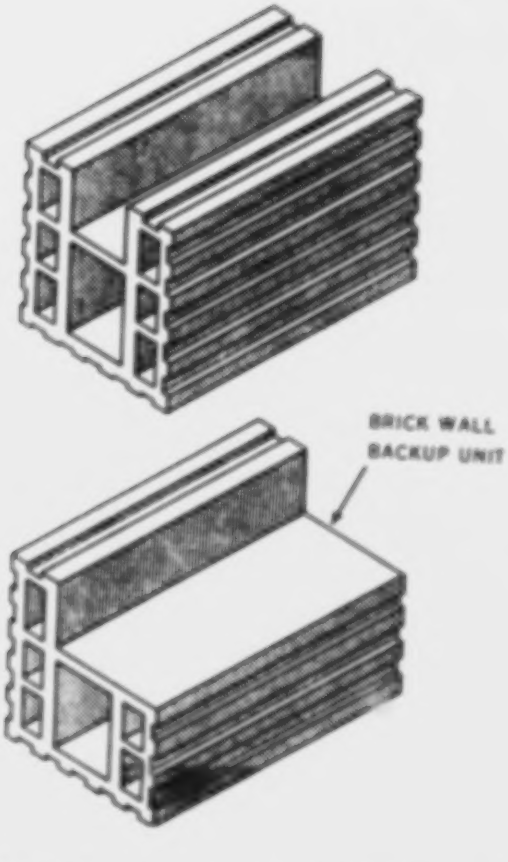

BRICK WALL
BACKUP UNIT

Figure 2. Structural Clay Tile

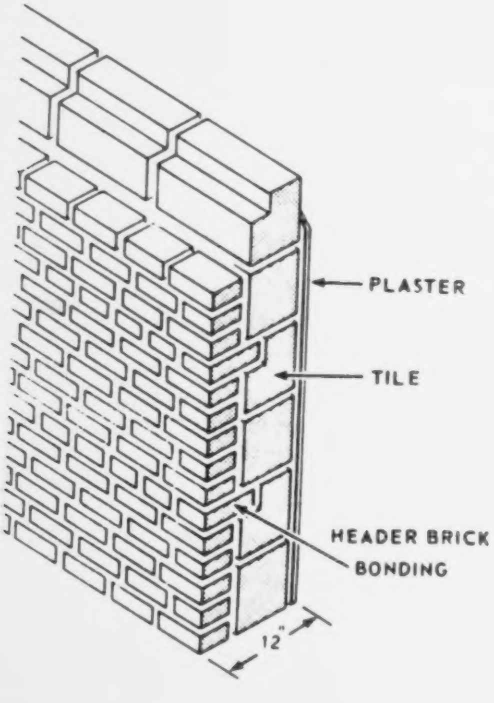

PLASTER
TILE
HEADER BRICK
BONDING
12"

Figure 3. How Structural Tile Are Used

Now that you have seen the basic masonry and structural units, the next step is to learn how a wall is actually constructed of these units. Concrete blocks and structural tile are laid in the same manner.

Designing Walls and Door or Window Openings

To achieve economy in construction, concrete masonry (block) walls should be laid out to use full and half length units. This minimizes cutting and fitting of these units on the job, operations which slow up the job of laying the block. All the dimensions such as the overall length and the height of the wall, the width and the height of a door or a window opening, and the wall areas between the doors, the windows, and the corners should be planned to use full and half units. Full advantage of modular design for block requires that door and window frames be of modular dimensions to fit the modular full and half size units. Figure 4 shows examples of the wrong and the right planning of block wall openings. Thus, using a nominal 8 X 8 X 16 inch block, both the horizontal and the vertical dimensions should be designed in multiples of 4 inches which gives you a good modular design.

If walls and other structural details are properly planned, block cutting is held to a minimum; however, there are times when you will need just part of a block.

You can cut block with a hammer and a broad chisel like the one used to cut brick. Score the block with light blows of a hammer and chisel where you want it to break, then use heavier blows until the block breaks.

Sometimes blocks and tile need to be cut for electrical switch or outlet boxes. This cutting can be done by using a small cold chisel and a hammer. Score the outline of the hole, then strike heavier blows until the block breaks on the line.

If accuracy and appearance are important, use a masonry saw to cut block and tile in the same manner as when cutting brick. Follow the manufacturer's instructions for using the saw.

Laying Out the Job

Before you start to lay the block you must first locate the exact location of the corners, establish the wall line and mark the head joints. Remember to use the modular design idea when the layout is being done. The corners can be located from the batter boards or by measuring out the length of the walls where they are to be laid and squared by the diagonal or 3, 4, 5 method. Mark these points on the foundation with a pencil, chisel or a chalk mark and then strike a chalkline from corner to corner to establish the wall line. The chalklined area establishes the outer edge of the block wall and the length of the course. The next step is called chasing the bond. This consists of laying out the first course of brick, without mortar, along the length of the wall to be constructed. To chase the bond place the first block on the

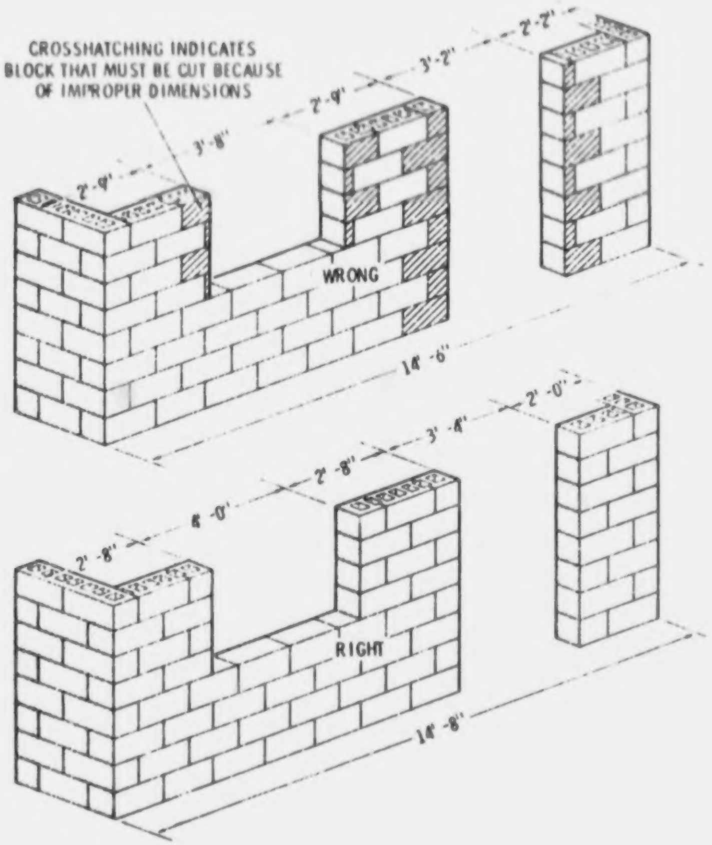

CROSSHATCHING INDICATES BLOCK THAT MUST BE CUT BECAUSE OF IMPROPER DIMENSIONS
2'-9"
3'-8"
2'-9"
3'-2"
2'-2"
WRONG
14'-6"
2'-8"
4'-0"
2'-8"
3'-4"
2'-0"
RIGHT
14'-8"

Figure 4. Proper Modular Designing

foundation where the corner will be located, be sure to use a corner block. Then place a rule or stick the desired thickness of the vertical joint (head joint) against the corner of the block. Then place a second block in position against the rule or stick and flush with the chalkline. Place the remaining blocks in position following this procedure. After chasing the bond, mark the position of each head joint on the edge of the foundation. If the job is not too large, you can chase the bond around the complete foundation allowing for half and whole blocks at the doors and windows. After marking all the head joints on the foundation you can build the corner leads.

Mortar Preparation

Good mortar is necessary to good workmanship and good performance within the wall. The mortar must bond the blocks into a strong well built wall. Mortar should be mixed in a power mixer, except for very small jobs where it may be mixed by hand. Mortar should be used within 2½ hours after original mixing when the temperature is 80° F or higher. When the temperature is below 80° F, the mortar should be used within 3½ hours. Mortar which is not used within these time limits should be discarded. Mortar that has stiffened on the mortar board because of evaporation can be retempered to restore its workability. To retemper the mortar, add water as required to obtain a workable mix. Mortar that has sitffened by hydration (setting) should be discarded. Since it is difficult to distinguish between the two causes of stiffening, the most practical method for deciding whether the mortar is good is using the amount of time elapsed from the initial mixing.

Building the Corners

The first portions of the wall to be laid are the corners or what are also called the corner leads. The corner leads are raised up 6 courses (a height of 4 feet) at both ends of the wall. To do this, spread and furrow a full mortar bed for several blocks in one direction and lay the corner block first. Position it carefully and accurately along the chalkline previously snapped to establish the wall line. Then lay several block along the wall line assuring not to move the corner block. All the block laid should have the thick edge of the face shell positioned up, as this gives a larger mortar bedding area, and the vertical joints are buttered to assure a full joint. The head joints can be applied to two or three blocks in one operation by placing several block on end and swiping mortar onto the ears (ends). After three or four block have been laid, the corner block is set to proper height using a story pole, then using a mason's plumb rule the blocks are leveled, plumbed and straightened. The first course of block should be laid with great care, making sure it is properly leveled, plumbed and aligned as this will assist you in laying the following courses and in building a straight true wall. Once one side of the corner is laid, follow the same steps for laying the other side.

The second course is half a block shorter each way than the first course and unlike the full mortar bed used in the first course, mortar is swiped on to the face shell of the block as illustrated by Figure 5.

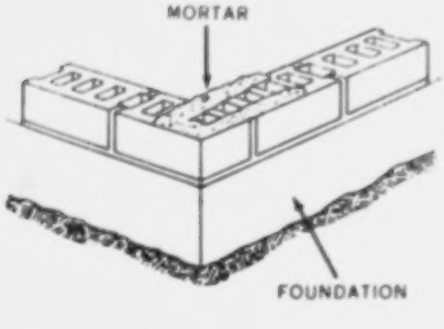


Figure 5. Mortar Swiped onto the Block

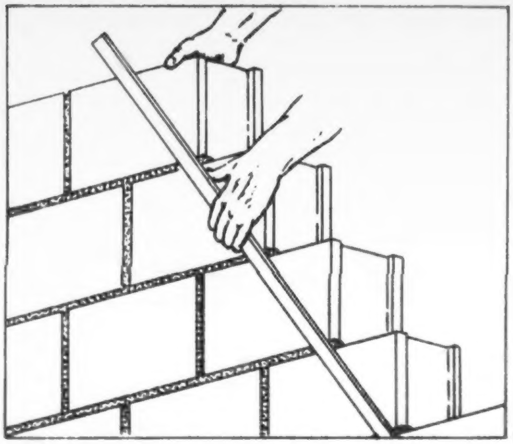


Figure 6. Checking the Horizontal Spacing

The remaining courses are stepped back half a block for each course until only a single corner block is laid. Check the horizontal spacing of these blocks by placing a straightedge diagonally across the corners of the blocks, as shown in Figure 6. Be sure to set each course to proper height and check to see if they are level, plumb, and straightedged. Once the corner leads are built the process of filling in the courses of block in between begins.

Laying to a Line

You should use a tightly drawn masons line, secured by some type of line holder (line pins, corner blocks, etc.) to obtain a true wall surface. Fasten the line so it is approximately a line's width away from the top edge of the block and level with the top edge. The first course of block should be laid with great care, making sure it is properly aligned with the head joint markings and the chalkline established for the wall line and the top edge of the block is laid a line's width away from the line. Having the block touch or crowd the line can cause the wall to bow and lean in or out. Also be sure the head joints line up with the marks on the foundation, if not the proper spacing will not be maintained.

The manner of handling or gripping the block is important. Practice will determine the best way for each person. While learning to lay block it is best to use two hands as the blocks are heavy and have a tendency of being hard to handle.

There are several different ways to lay block to a line, and the following is one way. Use whatever way is best for you. By tipping the block slightly toward you, you can see the upper edge of the course below, thus letting you place the lower edge of the block directly over the course below. Rolling the block up to a vertical position and shoving it, with a slight pressure, against the adjacent block allows the block to be laid to the line with minimum adjustment. Any adjustments made to the final resting position must be made while the mortar is soft and plastic. Any adjustment made after the mortar has stiffened will break the mortar bond and will have to be re-laid. Each block can be leveled and aligned to the line by tapping lightly with the trowel handle. The use of the mason's level between the corners when laying to the line is limited. It is limited to checking the face of each block to keep it lined up with the face of the wall. To stop the possibility of the mortar stiffening and losing its plastic quality, never spread the mortar too far ahead of the actual laying of the block. Usually swipe enough mortar for three or four block to be laid at a time. Be sure when laying block to a line that block are laid from both leads towards the middle. After laying each block, cut off all the mortar extruding from the head and bed joints. This mortar can be used to butter the head joints of the next block but is usually thrown back on the mortar board and retempered. When laying blocks from the leads towards the center, maintain the proper head joint spacings so the closure block will fit without needing to be trimmed or adjusting the other blocks. When installing the closure block, all edges of the opening or all four ears of the block must be buttered with mortar. Figure 7 illustrates a closure block being positioned with all edges of the opening buttered. The closure block should be lowered carefully into place and if any mortar falls out leaving an open joint, the block should be removed, fresh mortar applied and the laying operation repeated.

Tooling the Mortar Joints

Weathertight joints and a neat appearance of a concrete block wall need proper tooling. The tool used for tooling the horizontal joints should be at least 22 inches long or longer and have one end upturned to prevent gouging of the mortar joint. The handle should be located approximately in the center for easy handling. The vertical joints should be tooled with an S shaped jointer. After a section of the wall is laid and the mortar has become thumbprint hard is when the joints should be tooled. The tooling operation compacts and finishes the mortar joint by forcing it tightly against each side of the joint. Unless otherwise specified, all mortar joints should be tooled either concave or V shaped. Using a concave or V shaped jointer produces a waterproof joint. Tooling of the horizontal joints should be done first, followed by striking the vertical joints. Then the horizontal joints are struck again, as proper tooling will produce joints of uniform appearance with sharp, clean lines. After all the joints are tooled the mortar burrs and tags should be cut off flush with the face of the wall with a trowel. When the mortar has set enough so it won't mar, the wall may be brushed or rubbed with a stiff fiber brush or a piece of burlap to remove any dried particles.

SUMMARY

It is important to learn proper blocklaying procedures as an apprentice mason. The proper way to prepare a bed for mortar was also discussed. The method of spreading mortar for block construction varies considerably from that of spreading mortar for brick.

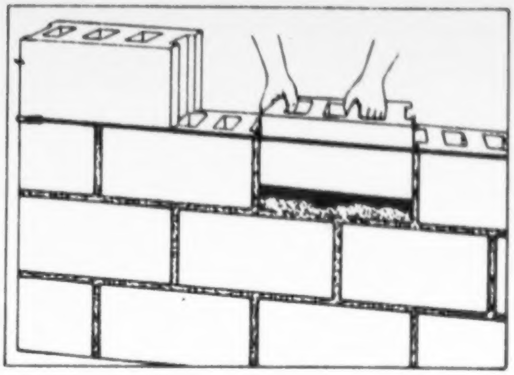


Figure 7. Laying a Closure Block to the Line

Getting the corners of a building started properly is one of the major steps in any masonry construction. Without the corners being started properly, the structure would lack strength and would tend to be a very unattractive unit when finished.

Laying to the line is a simple operation once you learn the techniques involved. As a masonry specialist you will probably have quite a few chances to lay block so take the experience and put it to good use.

QUESTIONS

1. A concrete block whose nominal dimensions are 8" X 8" x 16" has an actual size of ______________________.
2. ______________________ are normally required in exterior walls to lessen the possibility of absorbing water.
3. What is modular design?
4. Before you start to lay the block you must first ______________, ______________, ______________________.
5. After the mortar is mixed and the temperature is below 80° F how long can the mortar be used before it is discarded?
6. When laying concrete block having a face shell thicker on one side than the other, which side of the block would be placed up?
7. The proper mortar joint thickness for block is ______________.
8. When is the best time to tool the mortar joints of a block wall?

9. How many edges of a closure block are buttered?

10. Any adjustment to the final position of the block is made ____________ ____.

11. While positioning the closure block, mortar falls off one end, what should be done?

12. How many times is the bed joint struck?

13. Mortar burrs or tags are cut off the wall with a __________________.

14. How far from the line should the block be laid?

BRICK CONSTRUCTION

OBJECTIVE

Working as a member of a team, and using tools and materials provided, layout a site for a brick project. Site must be ready for construction of brick corners. Instructor assistance may be provided for most parts of the project.

Working as a team member, and using tools and common bricks provided, construct a corner for a brick project. The finished work must be within 1/4 inch of proper height and 1/4 inch of plumb. Instructor assistance may be provided for most parts of the task.

Working as a team member, and using tools and materials provided, construct a brick wall for a masonry project. The finished wall must be within 1/4 inch of proper height and 1/4 inch of plumb. Instructor assistance may be provided for most parts of the task.

INTRODUCTION

One of the earliest indications of man's development was brick masonry. Adobe bricks were made long before history was written. Sundried brick estimated to be 6000 years old have been found in excavations at ancient Babylonian cities. About 2500 years ago, the men of Babylonia were molding and making hard-burned brick. Babylonia was the brickmaking and bricklaying center of the world and it was probably from there that the art of brick masonry spread westward to Rome and eastward to China.

The term "brick masonry" identifies construction work that uses small brick blocks made of various clay and shale mixtures. The chemical and physical characteristics of the ingredients vary considerably. The color and hardness of the brick depend on the ingredients, kiln (oven) temperature, and baking time.

As an apprentice mason, you may be tasked to use various types of brick to build a structure with or to repair a structure. Brick offers you the chance to show your skill and perfection in probably the most complicated of the masonry fields. This study guide will cover types of brick, preparation for bricklaying and how to maintain brickwork.

INFORMATION

Assignment for Day 11

Read and study Chapter 1, pages 7-22 (Hollow Masonry Units) in textbook Modern Masonry, Goodheart-Wilcox, Inc., and answer questions 1-18 on page 29.

Read and study this study guide thru Bonding Brick and answer questions 1-2 at the end of the study guide.

Assignment for Day 12

Read and study Chapter 8, pages 106-111 (to Procedure No. 13 under Laying Brick) in textbook Modern Masonry, Goodheart-Wilcox, Inc. Read and study this study guide Bonding Brick thru Laying to a Line and answer questions 3-12 at the end of the study guide.

Assignment for Day 13

Read and study Chapter 8, pages 111-116 (Procedure No. 13 thru Laying Concrete Block) in textbook Modern Masonry, Goodheart-Wilcox, Inc. Read and study this study guide Laying to a Line to the end and answer the remaining questions.

There are many kinds of brick, and they are made of different materials. Some brick are used for specific purposes and are named accordingly. For instance, there are fireplace bricks used for building fireplaces, street bricks used in building streets and boiler bricks to line boilers, etc.

Kinds of Brick

Although there are many kinds of brick, as a mason in the Air Force you will be concerned mainly with those discussed below.

Common. Common bricks are made of common types of clay. They do not have special markings, scorings, colors or surface textures. Grades of common brick will vary in different localities. In some sections, the bricks are graded and sold as front and back bricks. The front bricks are those which have been burned to a higher degree of hardness. In nearly all localities, the overburned brick are called clinkers. These bricks are hard and durable.

Manufacturers sometime classify their bricks according to the degree of hardness, or color, or to their position in the kiln. Such terms as "arch", "clinker", "rough-hard", "red", "well-burned", "straight-hard", "stretcher", "soft" and "salmon", are applied.

Arch, clinker and rough hard bricks are hard, durable, and slightly irregular in shape. Red, well-burned and straight-hard bricks are well-baked but not overburned; and the most select of these bricks in size, hardness and durability are called stretchers.

Front brick - brick hard enough for exterior walls and structures - are known by names such as hard, common building, paving, hard building, outside, hard-red, straight-hard, select-hard, rough-hard, hard-washed, kiln-run hard, and common hard brick.

Soft brick are brick not hard enough for exterior walls of structures. These brick are baked at a lower oven temperature and are used for backup.

Other names or classifications are given common bricks, but the most important thing is to know the hardness and durability of the brick before it is laid. Brick laid in the exterior surface of the wall exposed to the elements should be hard and durable.

Face. Face brick are made of selected materials so that the hardness, size, strength, color, texture, etc., will be uniform and so that all bricks will be of a high-grade classification. They have surface markings or scorings to give them a pleasing appearance. Face brick are generally used for exterior tiers in walls exposed to the weather. They are also used for veneering, walks, steps, walls, etc., where beauty is desired and expense is no object.

Pressed. Any brick made by the dry-press process is called pressed brick. The brick may be common, face, or other kinds, depending upon the clay, coloring, and burning. Only the better grades of common brick are pressed. Pressed bricks are excellent for the exterior tiers of brick in outside walls. Burned pressed bricks are uniform in size, adhere more closely to standards of size, and are used where perfectly square corners are required.

Fire. Firebrick are made from special clays. Bricks made from these materials withstand high temperatures without cracking, and are used to line interiors of furnaces, fireplaces and other surfaces exposed to extreme heat.

Glazed. A glazed brick is one that has had one or more surfaces covered with a transparent glasslike (vitreous) coating. Glazed brick are used in exterior tiers of walls or partitions in bathrooms, hospitals, kitchens and other places where cleanliness and ease of cleaning are essential.

Imitation. Imitation brick are similar in size and shape to clay brick but are made primarily of portland cement and aggregate (sand). Imitation brick are not burned (heated) and have the same qualities as concrete made of portland cement and small aggregate.

Characteristics of Brick

There is a variation in the physical characteristics of brick due to the fact that brick are baked during manufacture and that during this process some brick shrink more than others. There is also some variation in color, weight and even strength due to this process. It is, therefore, important to you to know the physical characteristics of brick as well as their use.

Size. There are two standard sizes of ordinary brick. Common brick and rough-faced brick are 2¼ by 3 3/4 by 8 inches. That is, a brick this size is 2¼ inches high or deep, 3 3/4 inches wide, and 8 inches long. Smooth-faced brick or pressed brick are 2¼ by 3 7/8 by 8 inches. Brick will vary slightly from the sizes because of shrinkage during the burning process. Aside from the two sizes mentioned above, brick are also made in other sizes. Firebrick are ordinarily made 2¼ by 4½ by 9 inches in size.

Shape. Brick are of various shapes, however the standard brick are rectangular in shape. When a fourth of a brick is cut off, the remaining part is called a three-quarter bat or closure. When a brick is cut in half across the (3 3/4") face, both halves are known as half-bats. A brick cut in half parallel to its length (8") and having a nominal 2 inch face dimension is called a queen closer. A king closer is a brick with one corner clipped to leave a nominal 2 inch end and still have a full width end. A split is used from time to time and is just a slice of brick, although a brick with a 1/2" taken off can be considered a split. Figure 8 shows these various shapes (cuts) of brick.

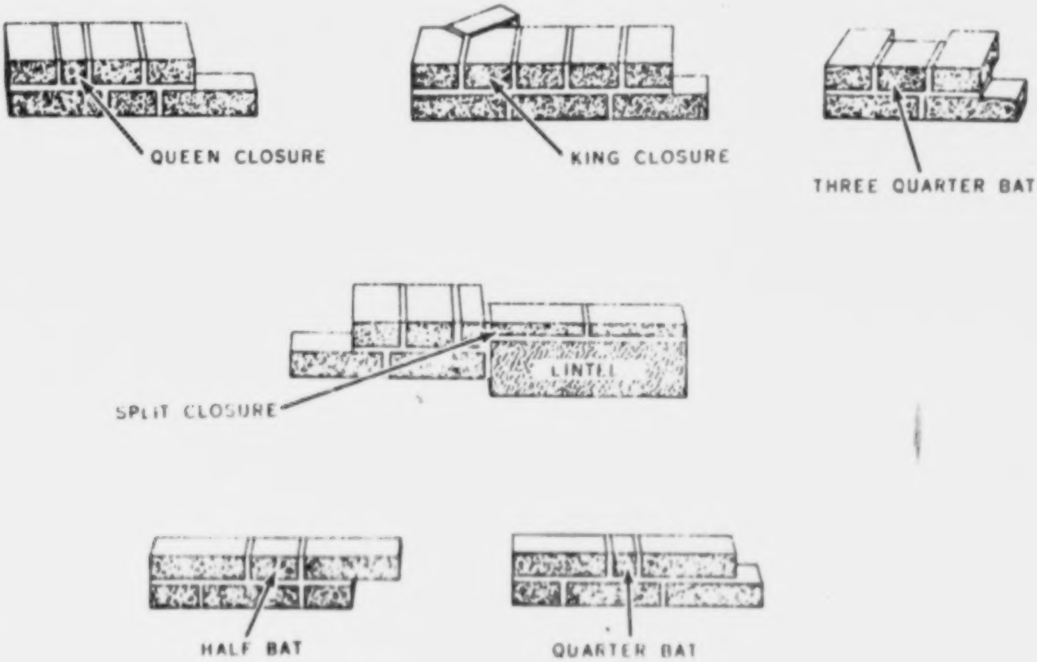


Figure 8. Various Cuts of Brick

Weight. The weight of a brick varies according to its size, the amount of burning, and the type and processing of material used in its manufacture. The approximate weight of a common brick is 4½ pounds.

Quality. Good quality brick must be uniform in size and shape. Their edges should be straight, square and well defined. Also, good bricks produce a metallic ring when two of them are struck together. The bonding surfaces are slightly rough so that a good bond can be obtained. Another characteristic of a good quality brick is that it will not absorb more than 10 to 15 percent of its dry weight in moisture when placed in a container of water for 24 hours.

Color. A large percentage of the brick produced in this country are red in color, but some, from certain localities, are yellow. Differences in the clay and the manufacturing process used account for the different shades. The amount of burning also causes slight differences in color, and bricks burned at different times may vary in color. If possible, obtain all of the brick required for a job at one time. This procedure will help maintain a uniform color of brick.

Strength. The compressive and tensile strengths of brick vary with the amount of burning (baking) and the types of materials used to manufacture them. When bricks are classified as vitrified, hard, medium, or soft, the vitrified brick are considered to be the strongest. The strengths of the other classes are in the order given. With any given brick strength, the strength of a wall constructed still depends on the workmanship and quality of the mortar joints. The strongest brick will not make a strong wall without the skill of a capable mason.

Handling Brick. Bricks must be handled carefully. Bricks come from the kiln in a variety of colors and they vary in size due to the amount of shrinkage. However, there are several techniques you can use to achieve a professional job.

Sampling. Keep a sample of face brick to be used on a construction job from the first load of brick that arrives at the site. All later loads of face brick delivered to the job site should be inspected and compared with the sample as they are being unloaded. By doing this, you can be assured that the bricks are uniform in quality, size and color.

Stacking. Stack face brick in neat piles on the job site. Place layers of straw between the courses to protect the faces of the brick. Face brick carried to the mason should be stockpiled face up on the scaffold for his convenience in handling.

Wetting. Normally, bricks are stacked where they can be wetted before they are used. In hot, dry weather bricks will absorb a considerable quantity of water. Use a hose of sprinkler to wet the brick but do not saturate them. There are several reasons for wetting the bricks just prior to laying:

(1) Damp bricks tend to spread the mortar more evenly under them and facilitate a better mortar joint.

(2) Damp bricks will adhere better to the mortar.

(3) A dry brick will absorb moisture from the mortar and cause it to set too fast.

(4) Wetting washes the kiln dust from the bricks. A clean brick will produce a better joint or bond with the mortar. Bricks should not be wetted during cold weather.

Cold Weather Precautions. Laying bricks during cold weather should be avoided, but, if it is necessary, keep the bricks absolutely dry and warm them before using them. Also, use warm water and warm sand when you mix the mortar.

Other Precautions. Bricks often require cutting or splitting into various shapes. There are several ways that bricks can be cut or split into the desired shape. A brick hammer can be used to split or chip a brick. A brick set can also be used with a brick hammer to make accurate cuts. Some masons use the heavy back edge of a trowel to quickly trim a brick to fit.

If a masonry saw is available, it should be used. Especially, if the job requires cutting of several bricks. The masonry saw leaves a smooth, even surface. Always wear a faceshield or goggles when cutting bricks. When operating the masonry saw, follow the manufacturer's instructions for safe operating procedures.

The purpose of bonding brick in masonry work is to make brickwork strong, solid and durable. To do this, you must place the bricks in such a manner that they are all tied together in a cohesive mass. Mortar joints will tie all bricks together but if you fail to place the bricks properly so that they will form a strong bond, the structure will not have the strength to support heavy loads. Bonding joints are made by lapping one brick over two bricks in the course just below it.

Bonding Brick. Since the brick of one course must overlap the brick in another course, the natural consideration is how much they should lap. In bricklaying, the practice to make a brick lap over bricks 1/4, 1/3, 1/2, or 3/4 of its length is called bonding. A brick should not overlap another brick less than 1/4 of its length. Figure 9 illustrates how vertical mortar joints are broken by lapping bricks.

As work progresses, the lap may be lost because of irregularities in the size of the brick and vertical mortar joint thickness unless special attention is given to maintaining lap. You should keep each vertical joint directly over the vertical joint two or more courses below. The process of keeping vertical joints perpendicular is referred to as "keeping the perpends".

Lapping places vertical joints between bricks in adjacent courses at relatively different positions. This may require that one or more brickbats of special size be used to make the course end properly at the ends or corners. The brickbats act as spacers or fillers to fill in space created by lapping the brick.

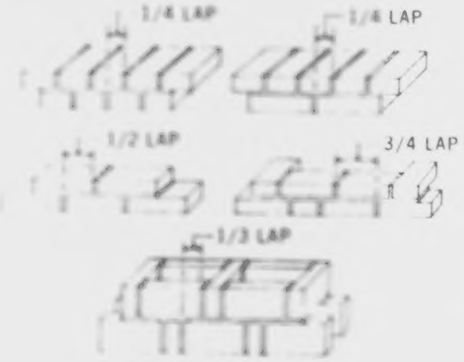

1/4 LAP
1/4 LAP
1/2 LAP
3/4 LAP
1/3 LAP

Figure 9. Lapping Bricks

Brickbats are placed in the course one or more bricks from the end, rather than at the end. This is particularly true when you are using small bats, because they tend to weaken the bond at the corner when placed as the last brick in the course. Figure 10 shows how quoins, bats, and closers are used as spacers and fillers.

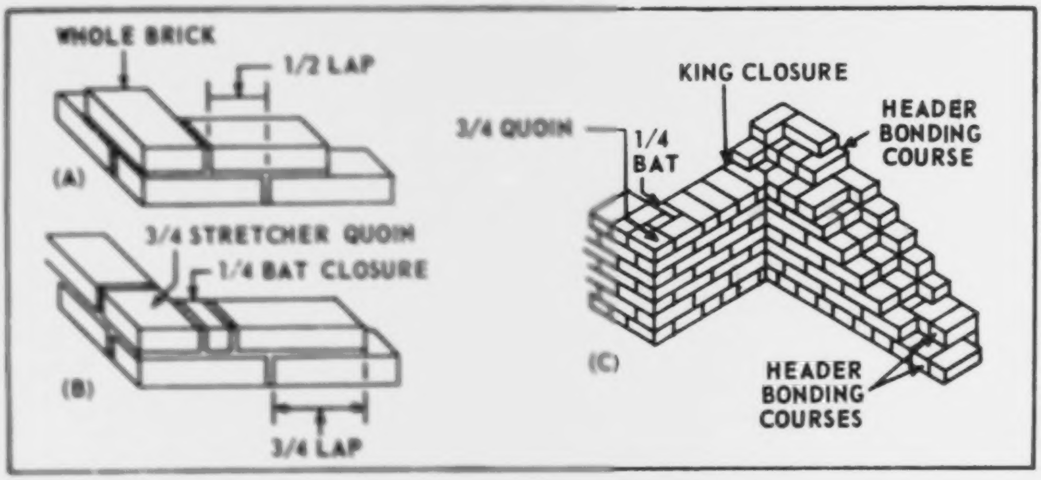

WHOLE BRICK
1/2 LAP
(A)
3/4 STRETCHER QUOIN
1/4 BAT CLOSURE
(B)
3/4 LAP
KING CLOSURE
3/4 QUOIN
1/4 BAT
HEADER BONDING COURSE
(C)
HEADER BONDING COURSES

Figure 10. How To Correctly Bond A Brick Wall

There are several different types of bonds used in bricklaying. There are five basic types of structural bonds. They are the running bond, the common or American bond, the Flemish bond, the English bond and the block or stacked bond.

Brick Wall Construction. By placing standard brick in various positions, you can construct walls in any thickness relative to the width and length of the brick. The width and length of standard brick are 4 inches by 8 inches when laid; therefore, walls may be constructed so that their thicknesses are any multiple of the width of the brick. Thus, the thickness of walls constructed of standard brick may be 4, 8, 12, 16, 20, 24, etc., inches.

The 4-inch wall and the 8-inch wall are the most popular and will be covered in this section. If additional wall thickness is required, concrete blocks or clay tile units can also be used to backup a 4- or 8-inch brick wall.

Four-inch Brick Walls. Four-inch walls are used for nonload-bearing walls and partitions. When a wood or steel frame is covered with a 4-inch facing of brick, it is called a brick veneer wall. Brick veneer can be applied to the framework of new or old buildings.

For new buildings, the foundation is made wide enough to accommodate a 4-inch brick wall. In old buildings, an additional 5- to 6-inch thickness of new foundation is extended below the ground against the old foundation to support the brick. The surfaces of frame buildings are covered with a good grade of waterproof building paper.

The arrangement of bricks in a 4-inch partition or veneer surface is the same; however, when you use brick for a partition, it is wise to select brick that are faced on both sides.

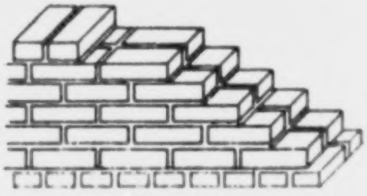
Bricks used to veneer an old building may require cutting, because the openings may not be spaced to accommodate normal brick spacing.

Four inch partition walls are normally laid using the running bond and are dependent on the strength of mortar and the lap of the brick in each course to hold them in place. Veneer walls are strengthened and secured to the structure by metal ties fastened to the framework and the other end embedded in the mortar between the courses of brick. A metal tie should be placed for each 2 square foot of wall area.

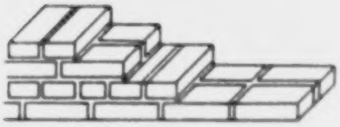
Eight-inch Brick Walls. Eight-inch brick walls are used in small structures, and under normal load conditions are thick enough to support the load placed on them. Larger buildings may require thicker walls of brick or backup units of concrete block or clay tile.

There are several bond patterns used for 8-inch walls. The three most common are American, English and Flemish bond. These bonds are shown in Figure 11. Notice how two 4-inch walls are tied together to strengthen the wall to make the wall 8 inches thick.

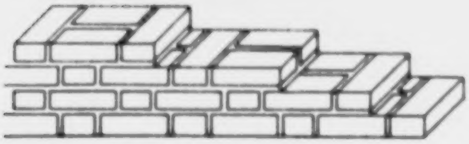
Sills, Lentils, Flashings and Copings. The architect or structural engineer works out the type of bond to be used in building a structure when it is designed. At that time, the sizes of door and window openings and distances between the openings are calculated to avoid any irregularities in lapping the brick and to reduce cutting brick to a minimum. You should make



COMMON



ENGLISH



FLEMISH

Figure 11. Bonds Normally Used for 8 Inch Walls

a trial layout course of brick (without mortar) in the bond specified to see how the openings work out.

Sills. Bricks in sills are usually laid on edge at a pitch or incline equal to one-half inch per foot of run. The method of starting a window opening and the position of the bricks placed in the sill mortar bed are shown in Figure 12.

This row of bricks is called a rowlock course and consists of bricks which have been placed on edge with their ends visible. They are used directly under window openings in brick buildings. A rowlock course is shown in Figure 13. For the construction of door sills, brick can be laid flat as a header course or on edge as a rowlock course.

Lintels. A steel lintel is used to support the brickwork over a window. A soldier course of brick can be used over the window opening. Figure 14 illustrates how the brick is placed on the lintel. Figure 14 also points out the window nomenclature that a mason needs to know.

A soldier course consists of brick which have been placed on end with one edge visible. They are used for arches and laid on steel lintels over wall openings. A soldier course of brick is also shown in Figure 13.

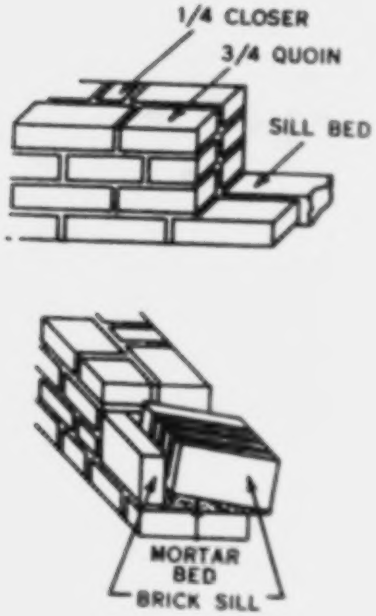


Figure 12. Constructing a Brick Window Sill

Bricks over door openings are supported by steel lintels similar to those used over window openings. A soldier course may also be used over door openings. Another possibility is to continue the pattern of brick used in the wall construction.

Flashings. Head flashings are bent metal strips placed over openings in brick walls as moisture barriers, and may extend completely through the wall. Copper strips are the best metal for this purpose; however, galvanized steel and aluminum strips can be used.

Note that the inside edges of the head flashings in Figure 15 are higher on the inside of the wall than on the outside. This directs the moisture downward and outward. Sill flashings are metal strips, similar to head flashings, used at the bottom of openings as a moisture barrier.

Copings. Copings are used to protect the tops of walls and other brickwork exposed to the weather. A concrete coping on top of a brick wall is shown in Figure 16. The coping bonds the top course of bricks and tends to prevent water from seeping into the mortar joints. Mortar joints saturated with water will freeze and loosen the brick during freezing weather. The drip, as shown in Figure 16, is a groove or slot extended all the way around the bottom of the coping so that the water passing from the top of the wall will be caught by the groove and will drip to the ground without coming in contact with the wall.

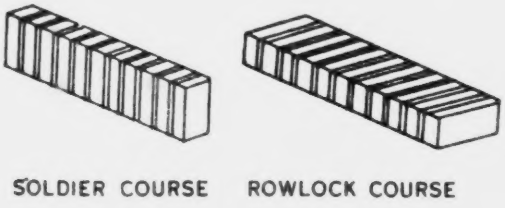

SOLDIER COURSE
ROWLOCK COURSE

Figure 13. Soldier and Rowlock Courses

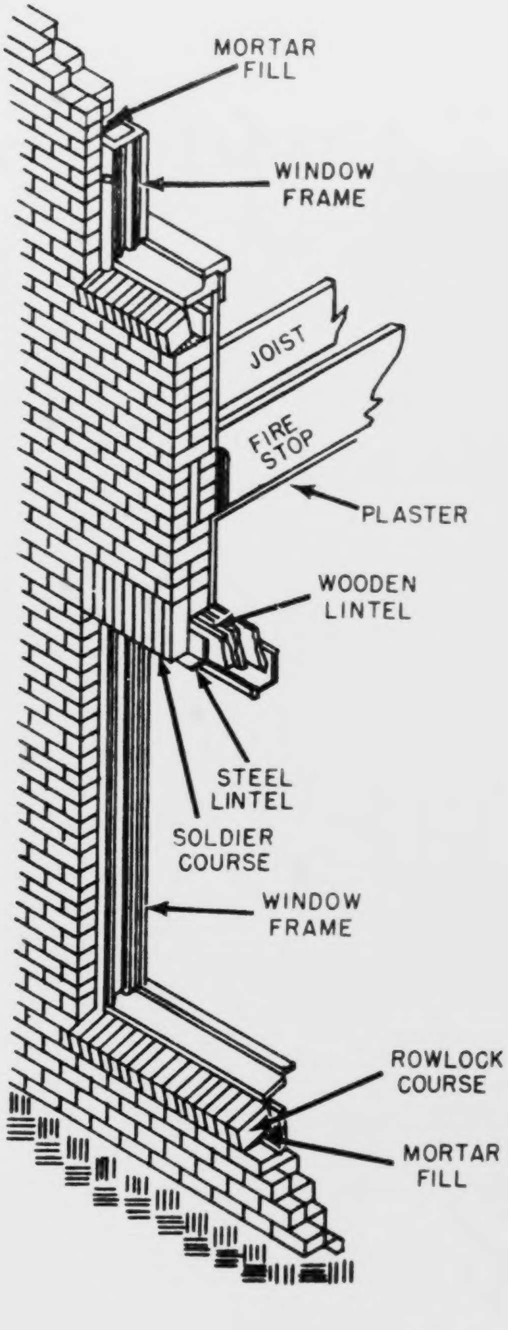

MORTAR FILL
WINDOW FRAME
JOIST
FIRE STOP
PLASTER
WOODEN LINTEL
STEEL LINTEL
SOLDIER COURSE
WINDOW FRAME
ROWLOCK COURSE
MORTAR FILL

Figure 14. Examples of Where Rowlock and Soldier Courses Can Be Used

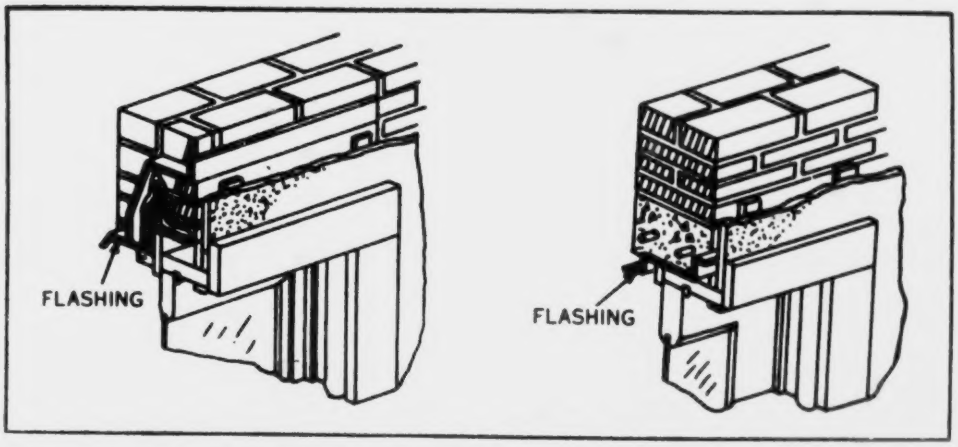


Figure 15. Head Flashings

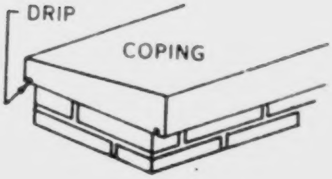


Figure 16. A Coping

Laying Out the Job. Before you start to lay bricks you must locate the exact location of the corners, mark the head joints, and establish the leads. Brick can also be laid out using the modular design method when using a running bond like block work. The corners can be located from the batter boards or by measuring out the length of the walls where they are to be laid and squared by the diagonal or 3, 4, 5 method. Mark these points on the foundtaion with a chisel or chalkmark, and then strike a chalkline from corner to corner. The chalkline establishes the outer edge of the first courst of brick, and the length of the course.

Chasing the bond. The next step is called chasing the bond, or measuring the bond. This consists of laying out the first tier or course of brick, without mortar, the length of the wall to be constructed. To chase (measure) the bond, place the first brick on the foundation where the corner will be located.

Then place a rule or stick, the desired thickness of the vertical mortar joint, against the corner brick. Place the second brick in position against the rule or stick flush with the chalkline which you made when you marked the outer edge of the first row of bricks.

Marking the Head Joints. After chasing the bond, mark the position of each head joint on the edge of the foundation. If the job is not too large, you can chase the bond around the complete foundation. After marking all the head joints on the foundation, you can establish the leads.

Establishing the Leads. The corners or first portions of the wall to be laid are called leads. Raise the leads at the corners of the wall and intermediate leads at several points in between, when the distance between corners is long. Build up the leads six or seven courses high before filling in the courses of brick between the leads. Use the level to keep the corner leads and intermediate leads plumb.

The height of the first corner lead depends on the number of courses in the wall and the bond being used.

Preparation of Mortar. Mortar is a combination of cement, sand and water. These materials must be of high quality and of the correct proportions to produce a good mortar. Good mortar is necessary for good workmanship. Mortar must have the characteristic of workability. Mortar is said to be workable when it spreads easily and remains firmly in the mortar joints. A workable mortar will stick to the masonry units. Mortar must also have good water retainability so it will remain soft and plastic long enough for you to aline and level the units.

To make a good mortar use sand that is free of dirt, vegetable matter, and salts. You can even produce a better mortar if the sand is uniformly graded and proportionately mixed.

There are several types of mortar sand, each having its own characteristics; so it would be difficult to specify the exact amount to use in preparing mortar. There should be enough particles of fine sand so that, when coated with cement paste, they fill the voids between the coarser sand particles. An excessive amount of fine sand particles requires more cement paste than a well-graded mixture.

The water used for making mortar should be as pure as drinking water. It should be free from chemicals, such as salts and alkalies. Large amounts of these chemicals or organic matter will affect hydration and the quality of mortar.

The best mortar is made of masonry cement; however, portland cement will make a satisfactory mixture by adding hydrated lime. Entrained air added to a mortar mix will add to the workability and water retainability of the mortar.

Mixing Mortar. Machine mixing should always be used except on jobs where the requirement for the amount of mortar is small. After the proper ingredients have been proportioned and placed in the mortar box or mixer, the quality of mortar depends on the mixing time. You can improve the quality of hand-mixed mortar by mixing it for a longer period of time.

Mortar that has stiffened on the mortar board should be retempered to regain its workability by remixing and adding a small quantity of water. After mixing the mortar, you should use it within 2 to 2½ hours if the temperature is 80° F, or higher. If the temperature is below 80° F, the mortar should be used within 3½ hours. Any mortar you don't use within the time indicated should be disposed of.

Bricklaying is more than a job. It is an art. Gaining a knowledge of the art and practice of the skills will be beneficial to help you obtain self-satisfaction in your job.

Building a Brick Corner. Bricklaying consists of applying the mortar to bond the bricks, positioning the bricks, laying the stretcher and header courses, and laying soldier and rowlock courses.

Applying the Mortar. Mortar is placed on a row of bricks by throwing it. During the throwing stroke, the mortar must flow evenly off your trowel from start to finish of the stroke. To start the throwing stroke, bring the trowel of mortar to the horizontal position, as shown in Figure 17, slightly ahead of where depositing is to start. Then, with a quick arm and wrist movement (toward the body) turn the trowel to a vertical position, depositioning the mortar on the brick. The throwing stroke from start to finish is shown in Figure 17.

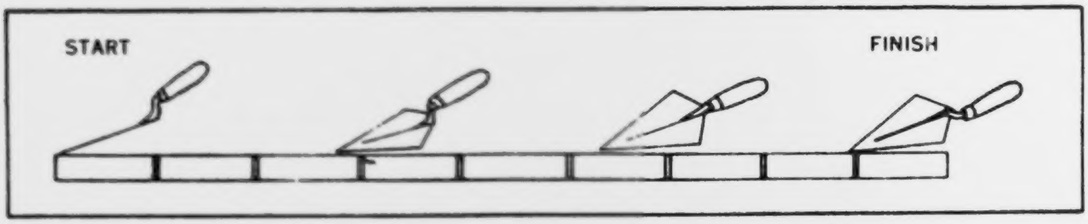


Figure 17. Throwing The Mortar

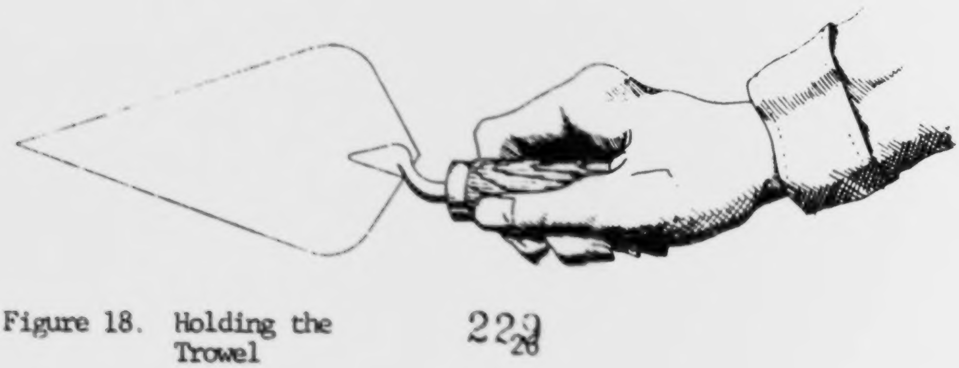


Figure 18. Holding the Trowel

After throwing the mortar on the brick, grasp the trowel in the palm of your hand so that the tool may be turned upside down when riffling the mortar. The proper way to grasp the trowel is shown in Figure 18. After depositing the mortar, turn the trowel in an upside-down position and riffle the mortar, as shown in Figure 19. To riffle mortar, run the point of the trowel down the center of the mortar to spread it. Then run the trowel down each side of the center to work the mortar toward the edges of the brick. Spread the mortar past the edges of the brick so that it hands over the edge of the bricks. This will insure a full bed joint. The excess mortar can be cut off with a trowel after the brick is placed in position on it.

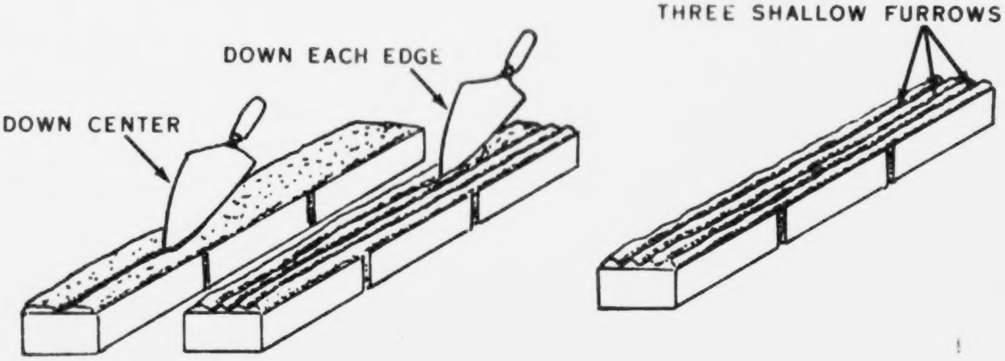
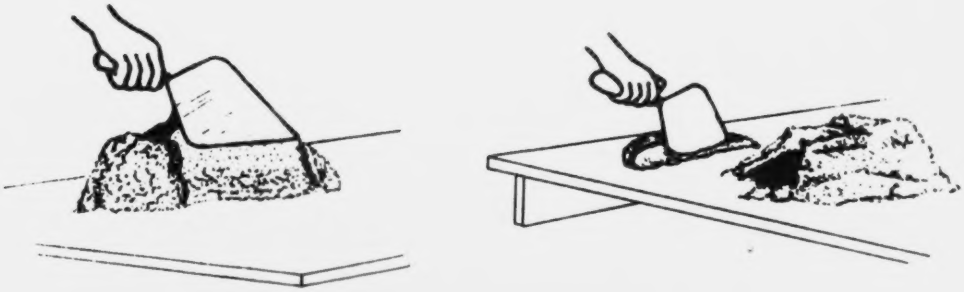


Figure 19. Riffling the Mortar



ROUNDING THE MORTAR PILE

TAKING MORTAR FROM SIDE OF PILE

Figure 20. Caring for the Mortar

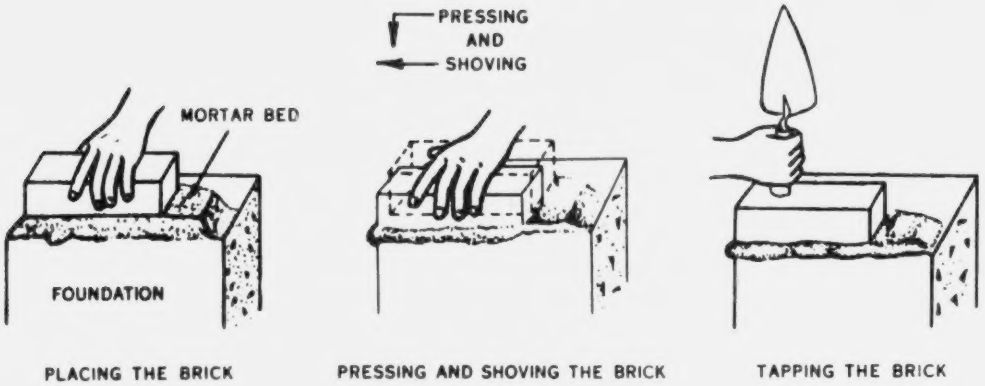


Figure 21. Positioning the Corner Brick

To keep the mortar from drying out, keep your pile rounded and well mixed, as shown in Figure 20. To gather mortar, scrape a small amount from the main pile and slip your trowel under it. Try not to disturb the shape of the mound on the mortar board.

Positioning the Brick. After the riffling operation is completed, grasp a brick from the pile with the hand not used for handling the trowel. Lay the corner brick of the first course first. Grasp and place it on the mortar bed slightly away from its final position, as shown in Figure 21.

As the brick touches the mortar bed, press and shove it (with a downward motion) to as near its final position as possible. Then force it down with the palm of your hand until mortar is squeezed out all around the edges of the brick, and the bed joint is of the correct thickness. If the brick is exactly in its final position after being pressed and shoved, no more movement of the brick is necessary. However, this does not always happen, and it may be necessary to tap the brick into its final position. If this is necessary, tap the brick with the handle of the trowel, as shown in Figure 21.

When mortar oozes out around the edges of the brick during positioning, cut it off with your trowel, as shown in Figure 22. This will make the mortar joint flush with the face of the brick. You should cut off the overhanging mortar in such a way that you do not pull the mortar out of the joint. Make sure your trowel is flush with both brick or the brick and the foundation, as shown in Figure 22. Use the mortar you cut from the joint to butter the end of the next stretcher brick.

Maintaining joint thickness. Common thicknesses of mortar joints range from 1/4 inch to 1/2 inch. Of these, the 1/4- and 3/8-inch mortar joints are used the most because they are the strongest and the most water-resistant. Mortar joint thicknesses can be determined from the building plans and specifications for the job.

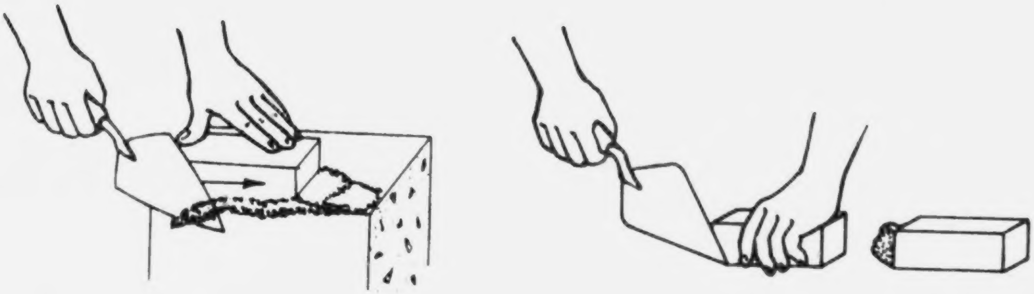


Figure 22. Cutting Off Mortar and Buttering a Stretcher

Lay out the height of each course (including bed joints) on a strip of wood, as shown in Figure 23, so that the height of each course can be checked against it as the brickwork progresses. A strip of wood marked like that is called a story pole.

Set the corner brick to proper height using the story pole, and then level and plumb it. Continue laying the first side of the corner the order illustrated in Figure 24 (No. 2, 3, 4, 5 and 6). Then level the first course as necessary by tapping the brick. After leveling the brick, plumb the last brick of the course and then straightedge the brick to insure they are aligned with the chalkline. When the level is used to straightedge the brick in between the two plumb points (the corner brick and the last brick of that course) the bubbles are disregarded and used as a straightedge.

Now you can throw and spread mortar on the foundation to lay the six bricks on the other side. Follow the same procedures and lay the remaining (No. 7, 8, 9, 10, 11, and 12 in Figure 24) brick for the first course. Level plumb, straightedge and square the first course to eliminate any errors that may have developed while laying. Check the height of the first course with a story pole to assure that the mortar joint is of the correct thickness. Cut off all overhanging mortar.

Next, spread the mortar on the lead just completed and lay the six stretchers (No. 13, 14, 15, 16, 17 and 18 in Figure 24) following the same procedures as the first course. Set the corner brick first, set it to proper height, level it, plumb it and then continue laying the remaining brick. Then level the second course, after leveling assure they are plumb and straightened. Once the first side of the second course is laid then repeat the process and lay the remaining brick of the second course (No. 19, 20, 21, 22 and 23 in Figure 24).

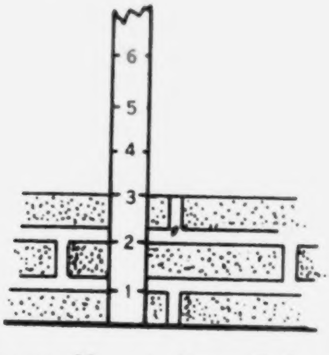


Figure 23. A Story Pole

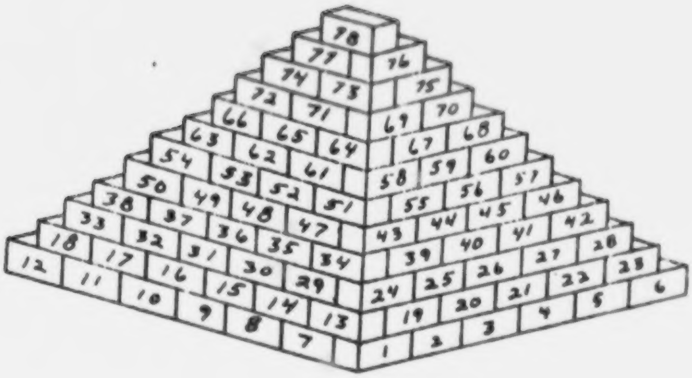


Figure 24. A Brick Corner

If it is necessary to align a brick by tapping, be sure to do this while the mortar is still plastic. Otherwise, you will break the bond between the brick and the mortar. Once again level, straightedge, and square the corner. Cut off any overhanging mortar and tool the joints as needed.

Lay the remaining courses in the corner following the same procedures as the first two. As the corner progresses be sure to level, plumb and straightedge each course.

Strike and tool the mortar joints as work progresses and examine and touch up the joints from time to time as needed. Now that the corner is completely raised, brush it down to eliminate the thin fringes of mortar around the edges of the mortar joints. Raise the second, third, and fourth corners in the same manner that you raised the first corner and then start laying the brick in between the corners.

Laying to a Line

You should use a tightly drawn line, secured by line holders, (pins, corner blocks, etc.) to help you obtain a true wall surface. Fasten the line so it is a line width away from the top edge of the brick and level with the top. Lay the first course between the corner leads with great care, making sure it is properly aligned with the head joint markings and the chalk line established for the wall line. Be sure when the brick are laid in position they are laid a line width away from the line. A line stretched between two leads is shown in Figure 25. When the distance is long between the corners use a line twig to help support the line between the corners.

To avoid disturbing the line while laying to the line, grasp the brick as shown in Figure 26. The left view shows how to grasp the brick when you are standing outside the line and laying the brick across the line. The right view shows how to grasp the brick when you are standing inside the line.

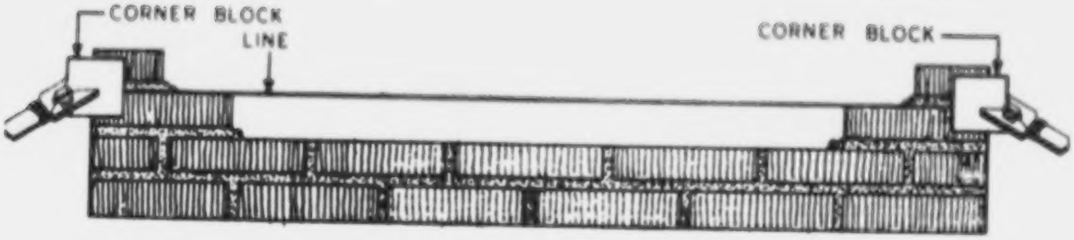


Figure 25. Line Fastened Between Corner Blocks

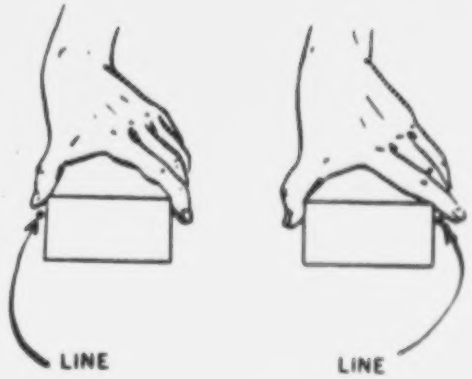


Figure 26. Grasping the Brick

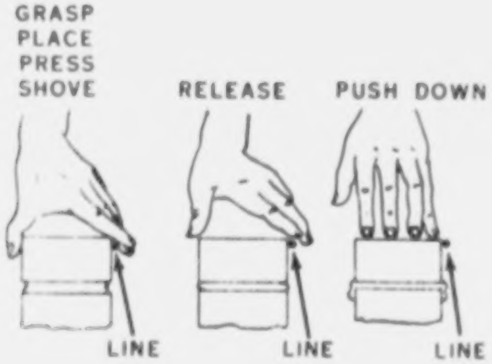


Figure 27. Laying Brick to the Line

After grasping the brick, place, press and shove it into place to obtain the correct thickness of head or cross joint. Next, release it and then press down once more to obtain the correct thickness of the bed joint. Figure 27 shows you how to lay the brick to the line.

Follow this process, laying the brick from both corners towards the middle and laying the closure brick. The closure brick or the last stretcher brick in the wall should fit within the opening left for it if attention has been paid to the head joint markings. If the closure brick fails to fit by 1 to 1½ inches, you can adjust the thickness of the head joints accordingly to make it fit. Lay the remaining stretcher brick in the same manner, being sure to cut off all the mortar extruding from the head and bed joints. Like block work this mortar can be used to butter the head joints of the next brick. If it is not used to butter the next brick it is thrown back on the mortar board and retempered.

Laying Rowlock and Soldier Brick. To form rowlock courses, lay brick on their edge; to form soldier courses, lay brick on their end on a bed of mortar spread on the lintel like that prepared for strecther or header brick.

The additional procedures you must follow when buttering these brick are as follows (1) apply mortar to the entire face of each brick; (2) butter all four edges of one side of the brick to form a full, complete cross joint when the brick is laid. The procedure to follow when buttering rowlock or soldier bricks is shown in Figure 28.

After you complete the job and clean the tools of mortar, you will need to clean the wall of any mortar stains which may have occurred.

Finishing Mortar Joints. Joints in brickwork like block work are formed to make them attractive as well as to make them watertight. After laying a few courses of brick and the mortar has become thumbprint hard, strike (or finish) the joints. This is also referred to as tooling the joints. The tooling operation compacts and finishes the mortar joint by forcing it tightly against each side of the joint. To make a flat (or struck) joint, hold the edge of the trowel against the edge of the brick, and pull the trowel along the joint after you cut off the overhanging mortar. A flat or flush mortar joint is shown in Figure 29.

To form an inclined or weather-type joint (like that in Figure 29) turn the trowel to a slight angle and strike the joint downward with the top edge of the blade. To form a raked joint, rake out a portion of the mortar in the joint with a flat jointer. You can form a flush concave joint (like that in Figure 29), by compressing the mortar in the joint with a convex jointer. Use a brush to remove fine particles of mortar from the face of the bricks.

Tooling the horizontal should be done first,followed by striking the vertical joints. Then the horizontal joints are struck again, as proper tooling will produce joints of uniform appearance with sharp, clean lines. After the joints are tooled the mortar burs and tags should be cut off flush with the face of the wall with a trowel. When the mortar has set enough so it won't mar, they may be brushed with a stiff fiber brush to remove any dried particles.

SUMMARY

You have learned about the types of bricks, their [illegible], the mixing of mortar, and the details of some of the procedures and techniques of brickwork. You probably found that they are not extremely difficult. However, they do require careful study and forethought and a great deal of practice.

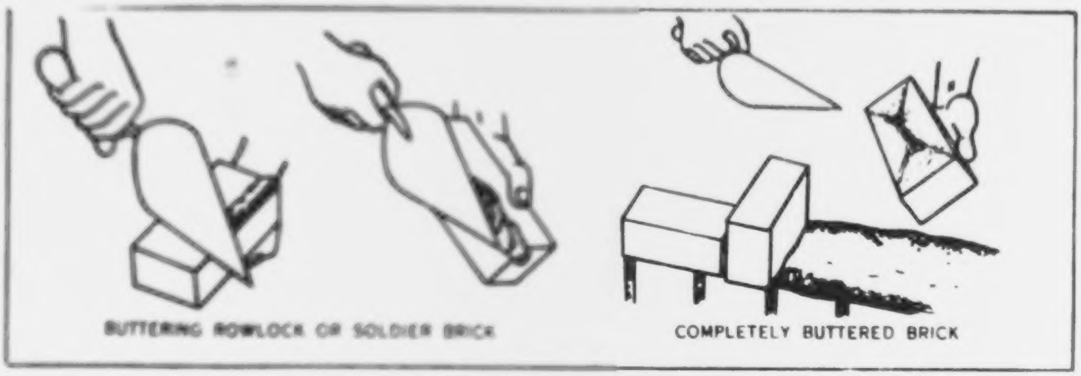

BUTTERING ROWLOCK OR SOLDIER BRICK
COMPLETELY BUTTERED BRICK

Figure 28. How to Butter a Rowlock or Soldier Brick

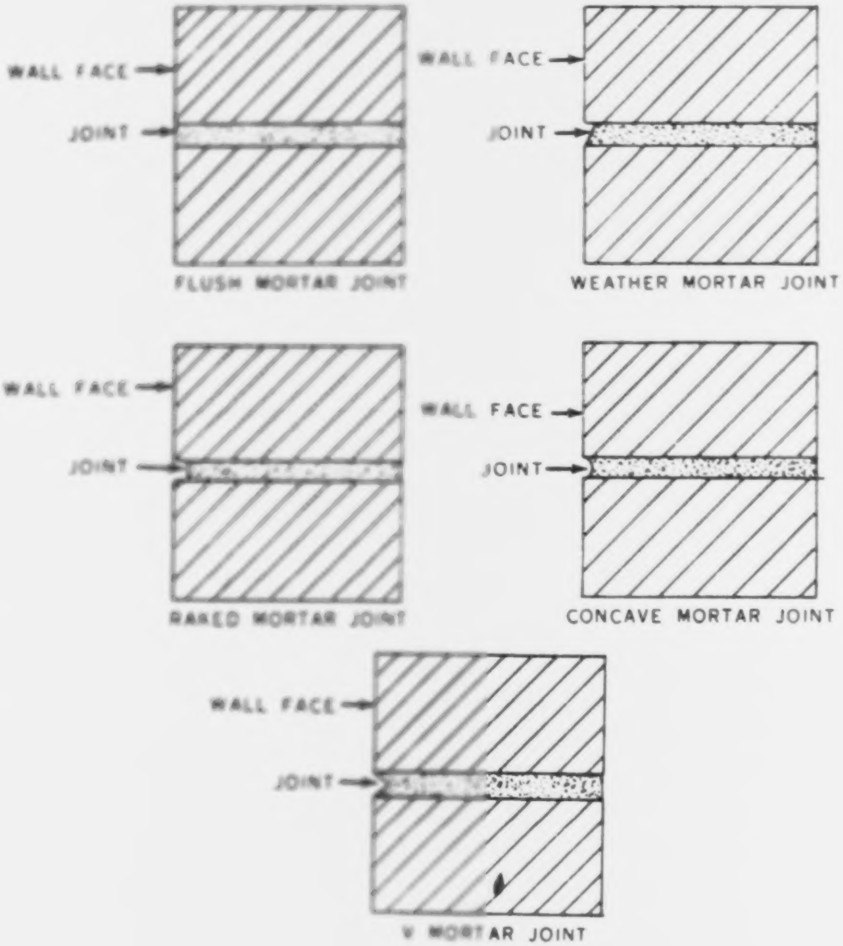

WALL FACE
JOINT
FLUSH MORTAR JOINT
WALL FACE
JOINT
WEATHER MORTAR JOINT
WALL FACE
JOINT
RAKED MORTAR JOINT
WALL FACE
JOINT
CONCAVE MORTAR JOINT
WALL FACE
JOINT
V MORTAR JOINT

Figure 29. Types of Mortar Joints

Bricklaying is an art all by itself. Determining bond, laying corners, leveling, plumbing, spacing the stretchers all become critical when erecting a brick wall. Considerable practice is necessary to perform all these functions skillfully. Even after erecting the wall, the mason's job is not finished. The mason must clean the mortar stains and repair any cracks in the masonry surface.

QUESTIONS

1. Name the type of brick or the use of the brick described here:

   a. A brick 2½" X 4½" X 9 inches

   b. A brick cut in half across the 3 3/4" face

   c. A brick 2¼ X 3 3/4 X 8 inches

   d. A brick that weight 4½ pounds

2. Match the following by placing the letter of the Column B item beside the number of Column A item or items that most nearly describes it. Each element in Column B may be used once, more than once, or not at all.

   Column A

   _____1. Face

   _____2. Pressed

   _____3. Fire

   _____4. Glazed

   _____5. Imitation

   _____6. Common

   Column B

   a. Made of portland cement and sand

   b. Used to line furnaces

   c. Used in walls exposed to weather

   d. Brick used for both front brick and back brick

   e. More uniform and used where square corners are desired

   f. Used in hallways of hospitals

3. A brick should not overlap another brick less than __________________.

4. __________________ can be applied to the framework of new or old buildings.

5. What are the five basic structural bond?

6. What is used to support the brickwork over a window?

7. What is laying out the first tier or course of brick without mortar, the length of the wall called?

8. What is a lead?

9. What is used to check the height of each course of brick?

10. Mortar is a combination of ___________, ___________, _______________.

11. After throwing the mortar, what must be done before setting the brick?

12. What are the sizes of the mortar joints most used in brickwork?

13. Brick are laid tight against the line. True or False?

14. Tags of mortar are removed from the brick with a _________________.

15. A brick wall is usually laid one course at a time from leads towards the center. True or False?

16. When the distance is long between the corners, what can be used to support the line?

17. Match the following by placing the letter of the Column B item beside the number of the Column A item or items that most nearly describe it. Each element in Column B may be used once, more than once, or not at all.

Column A	Column B
____1. Made by pressing mortar with a round rod-shaped tool.	a. Flat or flush joint
____2. Made with a flat jointer.	b. Weather mortar joint
____3. Made with a trowel held at a straight angle.	c. Concave mortar joint
	d. "V" mortar joint
	e. Raked Mortar joint

MAINTENANCE AND REPAIR OF MASONRY STRUCTURES

OBJECTIVE

Using information and materials provided, inspect, clean and repair joints and cracks in a masonry surface. Instructor assistance may be provided for most parts of the task.

Using information and materials provided, apply dampproofing and waterproofing materials to masonry structures. The surface must be 75% covered. Instructor assistance may be provided for most parts of the task.

INTRODUCTION

Planned preventive maintenance calls for crews of skilled individuals who can find defects and fix them. The job of the mason, on such a crew, is to completely inspect, install replacements, and make repairs on concrete block, cinder block, brick, concrete, and other types of masonry walls, chimneys, foundations, walks, floors and like structures. Also, the mason must be able to repair and replace defective tile, plaster, firebrick, cast material, fire clay, mortar and other similar materials. Major repairs beyond the scope of preventive maintenance and defects involving skills other than masonry are reported to the proper supervisor or other designated authority within the organization.

INFORMATION

Read and study Chapter i, "Cleaning New Masonry", pages 127-128, Chapter 9, "Dampproofing Basement Walls", pages 134-135 in textbook, Modern Masonry, and the following information in your study guide and answer the questions.

BRICKWORK MAINTENANCE

After you complete any bricklaying project, regardless of how careful you have been, there will be mortar stains on the bricks. When the wall has been in use several years, it is also often necessary to repair cracks and repoint the mortar. Sometimes a brick wall requires the surface to be cleaned to remove efflorescence.

Brickwork maintenance is very limited. It consists chiefly of cleaning the brick, removing the efflorescence and repointing the mortar joints.

Removing Efflorescence. Efflorescence is a white power or crystallization deposited on the surface of brickwork and is the result of water carrying water-soluble salts. These salts are usually prominent in the mortar or plaster used on a brick wall.

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Since moisture is necessary to carry soluble salts to the surface of bricks, efflorescence is the evidence of faulty construction. Wet walls may be due to defective flashings, gutters, downspouts, copings, or improperly filled and separated mortar joints. Repairs should be accomplished before you remove efflorescence or it will re-occur. To remove the efflorescence, scrub the wall with water and a stiff brush.

Repointing Mortar Joints. Bricks walls exposed to the weather for many years may need the joints repointed to improve their appearance and to make them watertight. The original mortar wears away due to the effects of rain, wind, heat and freezing weather.

The first step in repointing mortar joints is to inspect them. Use a sharp object as a probe to test the joint. If it is soft and crumbles easily it needs repointed. Also you should visually check for eroded areas as water could penetrate and cause a leak or damage the brickwork. The next step is to clean out the old mortar in the joints to a depth of at least 1/2 inch. Loosen the mortar with a thin chisel or scraping tool. Remove the dust and loose particles with a stiff brush. A jet stream of water may also be used to clean the joint. If water is used in cleaning the joints, no further wetting is required.

Wet the joints with water and a brush, if not done previously, then apply mortar to the joint with a tuck point trowel having a blade slightly narrower than the width of the joint. Before the mortar sets, point it with the pointing tool to produce the finish you desire. This step is very important, because the pointing tool will help force the mortar into the joint so that it completely fills the cavity and sticks to the old mortar and brick. Mortar for repointing should be mixed to match the mortar in the original brickwork.

Methods of Cleaning Brick. The wall must be allowed to set up and cure before cleaning. Soap, ammonia and detergents are used to remove dirt or soot deposits. To remove mortar stains, use a solution of hydrochloric or muriatic acid mixed with water. The ratio of the mix is 10:1 (10 parts of water to 1 part acid). A solution of phosphoric acid can also be used but the ratio of the mix is 5:1 (5 parts of water to 1 part acid).

CAUTION: Always add the acid to the water; acid reacts violently when water is added. Thoroughly wet the bricks with water before cleaning them to prevent the mortar stains from being drawn into the pores of the bricks.

Be sure to wear protective clothing, such as gloves, coveralls, and goggles, before applying the acid solution. Apply the acid with a long-handled, stiff-fiber brush. Scrub an area of 15 to 20 square feet and then immediately wash the area with clear water to prevent acid from damaging the mortar joints.

BLOCK MAINTENANCE AND REPAIR

Maintenance of concrete block and clay tile surfaces consist mainly of cleaning, filling mortar joints, and patching holes. Occasionally, you may be required to replace a block or a group of blocks.

Cleaning Block and Tile. Mortar which adheres to blocks and tile during the laying process should be removed before it hardens. Hardened, embedded mortar is very difficult to remove and paint cannot be depended upon to hide smears, so take particular care to prevent smearing mortar onto the surface of the blocks.

Do not use acid to remove smears or mortar droppings from concrete blocks. Mortar droppings that stick to the block should be removed with a trowel and rubbed with a small piece of concrete block (broken). Use a stiff-bristled brush to complete the job. This should remove practically all of the spot.

Filling Mortar Joints. Fill mortar joints that require it, in the same manner that you repaired joints in the brickwork. Use a small trowel and place fresh mortar in between the blocks. Retool the joint and brush the blocks clean.

Patching Holes. Holes made in blocks can be patched by removing damaged concrete and under cutting if possible. Wet the block and apply fresh mortar to fill the hole. Occasional dampening of the hole may be necessary to prevent the fresh mortar from shrinking away from the block. After the mortar dries, rub the excess mortar from the face of the block with a broken piece of block and finish by brushing.

WATERPROOFING AND DAMPPROOFING

Water which passes through masonry walls does not usually enter through the masonry or the mortar, but through cracks between the mortar and the masonry. These cracks are sometimes formed because the bond between the masonry and the mortar is poor. Concrete block are, however, somewhat of an exception, they do allow some water to pass through due to the block being semiporous.

To waterproof or dampproof a basement wall, the most common methods are the use of hot tar, membranes, cement plaster, and the tile drain method. All of these methods can be used with each other for better waterproofing.

Hot Tar. This is the simplest method. It consists of applying hot tar or asphaltum to the outside surfaces below ground. Apply it liberally with a mop or heavy brush. This method can be used where there is a limited amount of waterfall or where drainage is excellent,

Membrane. This method is used where excessive dampness occurs, and consists of applying hot tar or asphaltum with two or more layers of membrane (felt, roofing material, or plastic paper). Figure 30 illustrates this method. Note that the joint where the wall attaches to the footing is filled with concrete to form a slope, allowing the moisture to drain away from the footing.

Cement Plaster or Parging. This method is an effective way to construct a watertight wall. It consists of applying a 1 inch coat of cement plaster to the exterior surface of the masonry wall to extend 6 inches above the finished ground line down to extend over the top of the footing as illustrated in Figures 31 and 32.

Tile Drain. This method, as shown in Figure 33, is normally used where dampness is a big problem and in high rainfall areas. The walls should also be treated using the membrane method.

Lay clay or concrete tile, or perforated plastic pipe, around the footing with a gravel or cinder fill covering. The fill material allows the water to flow directly into the tile or pipe where it collects and drains off to some point away from the wall where it can do no harm.

Masonry walls above the ground are normally waterproofed or dampproofed with waterproof paint or a silicone sealer. These paints or sealers are normally applied with a wide paint brush, a paint roller, or by spraying and following the manufacturer's directions. Masonry to which portland cement paint is to be applied must age for at least 30 days before it is applied. These paints and sealers must have a complete coverage if they are to be effective, waterproof or dampproof a masonry wall.

SUMMARY

The repair and reconditioning of masonry units can be prevented from becoming a big and expensive operation, accompanied by extensive shutdowns, through a scheduling program of preventive maintenance. Initially, good building construction resulting from correct and proper handling, proportioning, mixing, placing, finishing, and laying of cementitious products and masonry units will do much to reduce the necessity for the repair of concrete and masonry work later on. Defective building construction, as well as defective concrete and masonry materials themselves are responsible for a high requirement for repairing and reconditioning masonry constructed units.

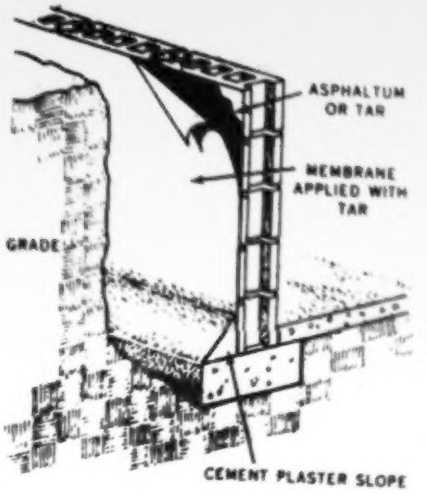

ASPHALTUM OR TAR
MEMBRANE APPLIED WITH TAR
GRADE
CEMENT PLASTER SLOPE

Figure 30. Waterproofing Membrane Method

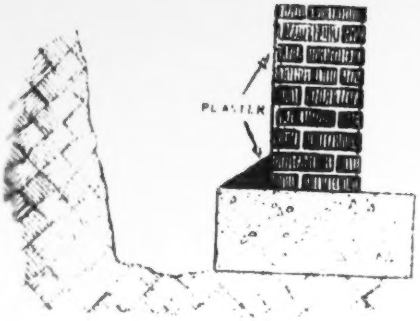


Figure 31. Waterproofing Plaster Method

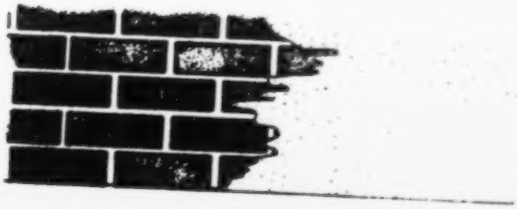
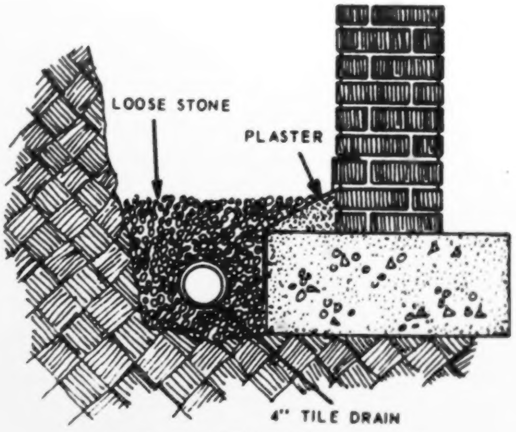


Figure 32. Brick Waterproofed Plaster Method


LOOSE STONE
PLASTER
4" TILE DRAIN

WHEN TILE DRAIN IS OMITTED, THE DRAIN IS CALLED A FRENCH DRAIN

Figure 33. Tile Drain Method

QUESTIONS

1. What is used to clean masonry walls?

2. What is the recommended method of repair for a hole in a concrete block wall?

3. In repointing of brick and block construction, the minimum depth of mortar removal from a mortar joint is

4. Why is it necessary to remove mortar stains from brick work?

5. What is used to remove mortar from joints that are to be repaired?

6. What is the final step in repairing a brick wall?

7. What tool is used to finish brick and block joints?

8. Match the following by placing the letter of the Column B item beside the number of the Column A item or items that most nearly describe it. Each element in Column B may be used once, more than once, or not at all.

Column A	Column B
____1. Cleaning brick	a. Wet the bricks prior to this operation
____2. Removing efflorescence	b. Use water and a stiff brush
____3. Repointing mortar joints	c. Add 10 percent muriatic acid to water
	d. Depends on the individual's taste.

WORKBOOKS

J3ABR55231 000-II-1-P1 thru 4-P2

TECHNICAL TRAINING

Masonry Specialist

BLOCK AND BRICK CONSTRUCTION

May 1983

USAF TECHNICAL TRAINING SCHOOL
3770 Technical Training Group
Sheppard Air Force Base, Texas

Designed for ATC Course Use
DO NOT USE ON THE JOB

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Supersedes WBs J3ABR55231 000-II-1-P1 thru 4-P2, November 1981

3770 Technical Training Group
Sheppard Air Force Base, Texas

WB J3ABR55231 000-II-1-P1
May 1983

CUTTING MASONRY MATERIAL

OBJECTIVE

Using masonry tools and equipment provided and exercising safety precautions, cut and shape bricks and block to sizes and shapes specified. Instructor assistance may be provided for most parts of the task.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-II-1	1/student
WB J3ABR55231 000-II-1-P1	1/student
Masonry saw	1/8 students
Brick hammer	1/student
Brick trowel	1/student
Brick and block	1/student
Safety goggles	1/student

Mission I

PROCEDURE

Using masonry tools and equipment provided and exercising safety precautions, cut and shape bricks and block to sizes and shapes specified. Instructor assistance may be provided for most parts of the task.

Using the Masonry Saw

You will use the masonry saw to cut the following masonry materials:

1. Brick - cut a 3/4 bat brick and a 1/2 bat.

2. Blocks - cut a 3/4 block and a half block.

Safety Precautions

1. Remove all jewelry.

2. Keep hands away from all moving parts.

3. Keep the work area free from debris.

4. Wear goggles while operating the saw.

Preoperational Check

1. Check equipment for proper lubrication.

2. Make sure the saw blade is tight.
3. Check the water supply.
4. Make sure that all movable parts are free to move.
5. Check the electrical powerline.

Operational Procedures

1. Measure and mark the material to be cut.
2. Place the material on the saw.
3. Doublecheck the safety precautions - goggles, hands, and debris
4. Turn on the water.
5. Start the motor.
6. Slowly move the blade into the material.

   NOTE: The blade should cut at its own speed. With a little experience you will learn how fast to cut various materials.

7. After completing the cut, turn off the motor.
8. Stop the waterflow.
9. After the blade stops, remove and inspect the cut material.
10. Repeat the procedures until you have completed all of your required cuts.

Brick Hammer

NOTE: Wear goggles while performing this project.

1. Procure a brick hammer and cut a 1/2 bat.

   NOTE: Hold the brick in your hand while cutting.

   CAUTION: Direct the hammer so that the wasted pieces of the brick will be knocked away from your body.

2. Use a brick hammer and cut a half block and trim the ears off one end.

   NOTE: The concrete block must be setting solidly on a base during the cutting.

Brick Set and Hammer

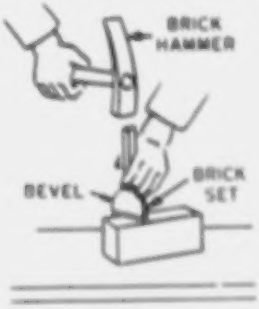
NOTE: Wear goggles while performing this project.

1. Procure a hammer and a brick set and cut the following building materials.

    a. Brick - cut a 1/2 bat and a 3/4 bat.

    b. Block - cut a half block.

USING A SET. A brick set may be used to cut a block and brick square across or at specified angles. The brick set is placed on the brick with the beveled edge of the tool toward the portion of the brick being cut off. When the set is placed in the correct position, it is struck with a brick hammer. Marking and cutting the brick and block on all four sides obtains smoother cut edges.



Cutting Brick with a Brick Set

Brick Trowel

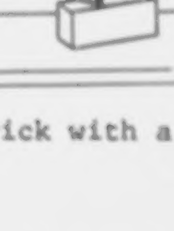
NOTE: Wear goggles while performing the project.

1. Procure a brick trowel and cut a 3/4 brick bat and a 1/2 brick bat.

2. Clean up the area.

3. Return all tools and equipment to the storage area.

USING A TROWEL. The trowel is sometimes used instead of the brick set to cut brick. It is used to make square cuts of common brick or block. The trowel and the brick must be held in certain positions to successfully cut the brick.



Cutting Brick with a Trowel

LAYING OUT A SITE FOR A CONCRETE BLOCK PROJECT

OBJECTIVE

Using instructions, tools, and materials, lay out a site for a concrete block project. The site must be ready for construction of a concrete block corner. Instructor assistance may be provided for most parts of the task.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-II-2	1/student
WB J3ABR55231 000-II-2-P1	1/student
50-foot steel tape	1/4 students
6-foot ruler	1/student

MISSION I

PROCEDURE

Using instructions, tools, and materials, lay out a site for a concrete block project. The site must be ready for construction of a concrete block corner. Instructor assistance may be provided for most parts of the task.

1. Obtain the necessary hand tools.
2. Go to the area assigned by the instructor.
3. Locate the corners.
4. Chalkline the wall line.
5. Chase out the bond - keep in mind modular designing.
6. Mark the head joints on the concrete.

Prepare a Story Pole

1. Select a straight 1X4-inch board.
2. Cut the selected board 54-inches long.
3. Select a modular rule.
4. Lay out the number of courses to equal 4 feet.
5. Lay out for a window sill at 36 inches.
6. Place an arrow to indicate the top of the story pole.
7. Keep this story pole; you will need it later.

CONSTRUCTING A CONCRETE BLOCK PROJECT

OBJECTIVE

Working as a member of a team, and using masonry tools and concrete blocks, prepare mortar and construct a corner for a masonry project. The finished work must be within 1/4 inch of proper height and 1/4 inch of plumb. Instructor assistance may be provided on most parts of the task.

Working as a member of a team, and using tools and equipment provided, construct a block wall for a masonry project. The finished work must be within 1/4 inch of proper height and 1/4 inch of plumb. Instructor assistance may be provided for most parts of the task.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-II-2	1/student
WB J3ABR55231 000-II-2-P2	1/student
Concrete block	1/student
Mortar mixer	1/12 students
Mixing box	1/12 students
Wheelbarrow	1/4 students
Hand tools	1/2 students
Hoe and shovel	1/4 students

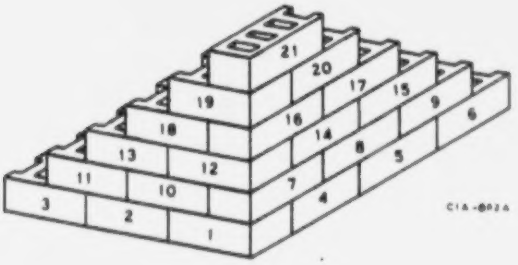
MISSION I

PROCEDURE

Working as a member of a team, and using masonry tools and concrete blocks, prepare mortar and construct a corner for a masonry project. The finished work must be within 1/4 inch of proper height and 1/4 inch of plumb. Instructor assistance may be provided on most parts of the task.

Building a Concrete Block Corner

NOTE: Build the corner six courses high. Use 8-inch block and strike the joints on the inside and outside.



Correct Numerical Order of Laying Up the Corner

The steps to follow when erecting a concrete block or structural tile wall are outlined below. Follow the step-by-step procedure as outlined. At any time any of the steps are not clearly understood, be sure to check with an instructor before proceeding.

1. Mix the mortar.
2. Spread mortar for the corner unit.

   NOTE: Be certain that the mortar is properly mixed before spreading.

3. Lay the first corner block. (Make certain that this block is in the same position as when the bond was laid out.)
4. Level the first corner block. (Test height)
5. Spread mortar for the second block.
6. Butter the end of the stretcher block.
7. Lay the stretcher block.
8. Level the stretcher.
9. Spread mortar for the second stretcher block.
10. Lay the stretcher block.
11. Level the lead.
12. Straightedge the lead.
13. Lay the other side of the first course. Follow the same procedures for the first side.
14. Square the corner.
15. Swipe on the mortar for the second course.
16. Lay the corner block in the second course.
17. Level the corner block in the second course.
18. Plumb the corner block.
19. Adjust the corner block. (Test height)
20. Lay the remaining stretchers.
21. Level the second course.
22. Plumb the second course.
23. Straightedge the second course.

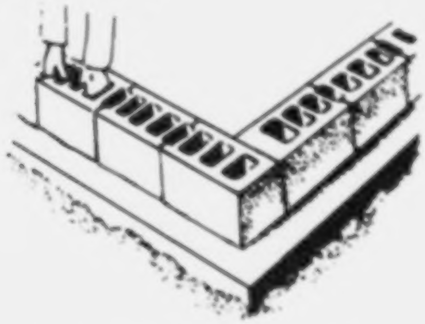
24. Test height of the second course.

25. Lay the remaining courses following the same procedures.

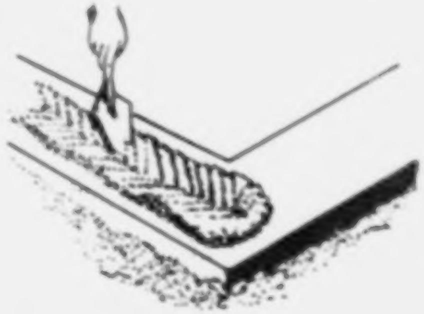
26. Strike the joints and touch up as necessary.

27. Clean and store the tools.

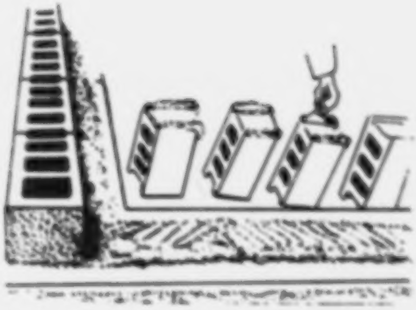
The following pictorial sequence will aid you in learning to lay concrete blocks:



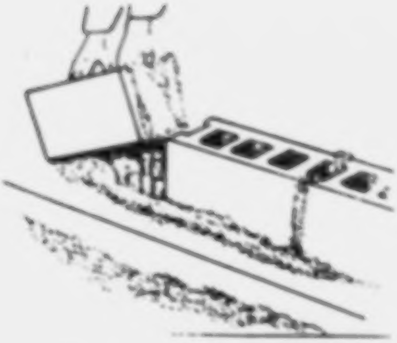
1. Chasing Out the Bond



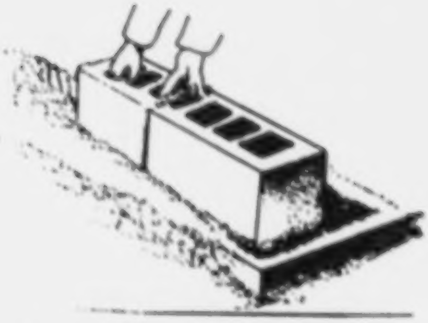
2. Spread and Furrow the Mortar Bed



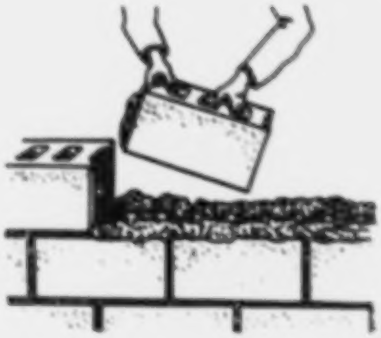
3. Butter the Ears



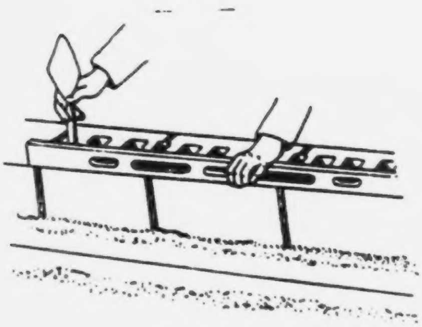
4. Blocks Buttered for Vertical Joints



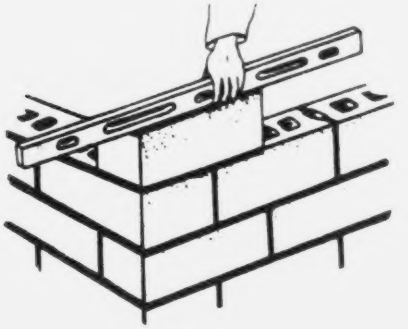
5. Positioning the Blocks



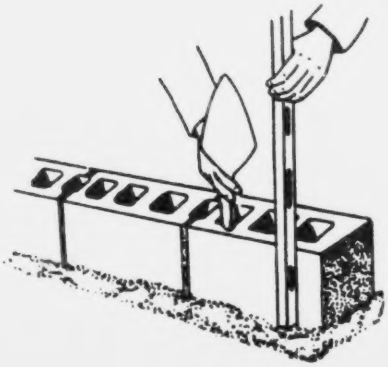
6. Vertical Joints



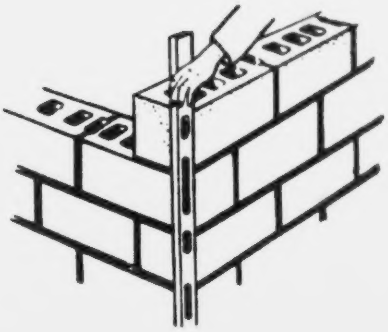
7. Leveling the Blocks



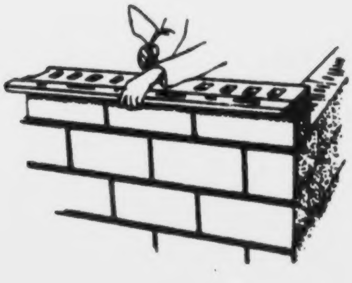
8. Leveling



9. Plumbing the Blocks



10. Plumbing



11. Aligning

MISSION II

PROCEDURE

Working as a member of a team, and using tools and equipment provided, construct a block wall for a masonry project. The finished work must be within 1/4 inch of proper height and 1/4 inch of plumb. Instructor assistance amy be provided for most parts of the task.

Constructing a Block Wall

NOTE: The four corners of the building have been completed. The next step is to build the walls. If the four corners have been properly constructed, building the walls is a simple matter.

Erecting the First Wall Section

1. Install the line. Have the line checked by your instructor before proceeding.
2. Fill in the first course stretchers.
    a. Spread the mortar.
    b. Butter the end of each stretcher block.
    c. Set the stretcher block.
    d. Butter both ends of the closure block.

NOTE: Be sure the blocks are laid accurately paying attention to the head joint markings and the chalkline established for the wall line.

3. Raise the line as necessary.
4. Fill in the remaining stretcher courses.

NOTE: Have your instructor check each completed course.

5. Strike the mortar joints.
6. Erect the remaining walls following steps 1 thru 5.

Cleaning Tools and Area

1. If the block work is not semi-permanent, dismantle the block, clean and restack.
2. Clean handtools.
3. Place all tools in proper storage area.
4. Wash down the area around the wall.

LAYING OUT A BRICK PROJECT

OBJECTIVE

Working as a member of a team, and using tools and materials provided, layout a site for a brick project. Site must be ready for construction of brick corners. Instructor assistance may be provided for most parts of the project.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-II-3	1/student
WB J3ABR55231 000-II-3-P1	1/student
50-foot steel tape	1/student
6-foot ruler	1/student

MISSION I

PROCEDURE

Working as a member of a team, and using tools and materials provided, layout a site for a brick project. Site must be ready for construction of brick corners. Instructor assistance may be provided for most parts of the project.

Lay Out a Brick Wall

1. Procure the tools you will need to lay out a brick wall. Name the tools required.

____

____

____

2. Go to the area assigned by the instructor.

3. Select the type of brick to be used. The brick selected is

____

4. Determine the type of bond to be used.

5. Prepare the foundation.

   a. Sweep the area.

   b. Wash the area with water, if necessary.

6. Measure and mark the corner locations.

7. Take diagonal measurements to insure that the foundation is square.

8. Measure and mark the window and door openings given to you by the instructor.

9. Chase the bond around the complete foundation.

10. Adjust the head joint to work out an even number of whole or half bricks.

11. Position the mortar tables.

12. Stock the work area with brick.

Prepare Story Pole

1. Select a straight 1x4-inch board.

2. Cut the selected board 48-inches long.

3. Select a course counter ruler with a #6 joint measurement.

4. Lay out the stretcher courses.

5. Lay out window sill height.

6. Place an arrow to indicate the top of the story pole.

7. Keep this story pole; you will need it later.

CONSTRUCTING A BRICK PROJECT

OBJECTIVE

Working as a team member, and using tools and common bricks provided, construct a corner for a brick project. The finished work must be within 1/4 inch of proper height and 1/4 inch of plumb. Instructor assistance may be provided for most parts of the task.

Working as a team member, and using tools and materials provided, construct a brick wall for a masonry project. The finished wall must be within 1/4 inch of proper height and 1/4 inch of plumb. Instructor assistance may be provided for most parts of the task.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-II-3	1/student
WB J3ABR55231 000-II-3-P2	1/student
Mixing box	1/12 students
Wheelbarrow	1/4 students
Hand tools	1/2 students
Mortar mixer	1/12 students
Hoe and shovel	1/4 students
Brick	1/student

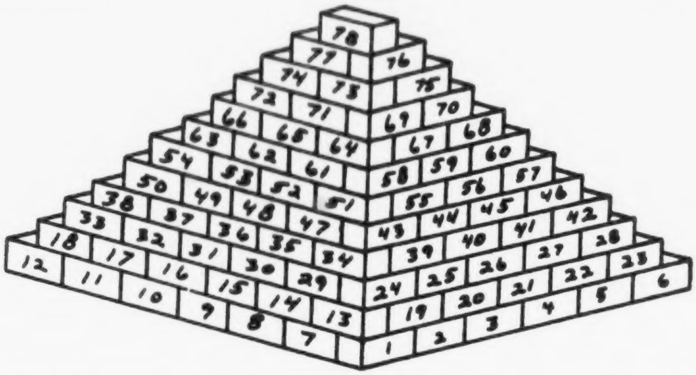
MISSION I

PROCEDURE

Working as a team member, and using tools and common bricks provided, construct a corner for a brick project. The finished work must be within 1/4 inch of proper height and 1/4 inch of plumb. Instructor assistance may be provided for most parts of the task.

Building a Brick Corner

NOTE: Build the corner 12 courses high. Use a common brick set to #6 on a course counter and strike the joints both on the inside and outside.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Correct numerical order of laying up the corner.

Follow the outlined step-by-step procedures below. At any time any of the steps are not clearly understood, be sure to check with an instructor before proceeding.

1. Mix mortar.
2. Spread and riffle the mortar for the corner lead on the first side.
3. Position the corner brick.
4. Butter the head joints and lay the remaining brick for the first side.
5. Level, plumb, and align the first course.
6. Repeat step 2 through 5 for the opposite side of the corner lead.
7. Check the bricks for levelness, plumb, straightness, and uniform joint spacing.
8. Check the corner for squareness.
9. Lay the remaining courses as per steps 2 through 7.
10. Strike the joints and touch up as necessary.
11. Clean and store the tools.

MISSION II

PROCEDURE

Working as a team member, and using tools and materials provided, construct a brick wall for a masonry project. The finished wall must be within 1/4 inch of proper height and 1/4 inch of plumb. Instructor assistance may be provided for most parts of the task.

Constructing a Brick Wall

NOTE: The four corners of the building have been completed. The next step is to build the walls. If the four corners have been correctly constructed, building the walls is a simple matter.

Erecting the First Wall Section

1. Install the line. Have the line checked by your instructor before proceeding.
2. Fill in the first course stretchers.
    a. Spread and riffle the mortar.
    b. Butter the end of each brick to be set
    c. Set the brick to the line.

d. Butter both ends of the closure brick.

NOTE: Be sure the brick are laid accurately paying attention to the head joint markings and the chalkline established for the wall line.

3. Raise the line as necessary.

4. Fill in the remaining stretcher courses.

NOTE: Have your instructor check each completed course.

5. Strike the mortar joints.

6. Erect the remaining walls following steps 1 through 5.

Cleaning Tools and Area

1. If the brick work is not semi-permanent, dismantle the brick, clean and restack.

2. Clean hand tools.

3. Place all tools in proper storage area.

4. Wash down the area around the wall.

INSPECTING, CLEANING, AND REPAIRING MASONRY SURFACES

OBJECTIVE

Using information and materials provided, inspect, clean, and repair joints and cracks in a masonry surface. Instructor assistance may be provided for most parts of the task.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-II-4	1/student
WB J3ABR55231 000-II-4-P1	1/student
Wheelbarrow	1/4 students
Hand tools	1/2 students

MISSION I

PROCEDURE

Using information and materials provided, inspect, clean, and repair joints and cracks in a masonry surface. Instructor assistance may be provided for most parts of the task.

1. Inspect a masonry wall.

   a. What caused this damage? ______________________________

   b. What is the best method of repair? ______________________

____

2. Use a hammer and chisel to remove the old mortar from the damaged area.

3. Mix mortar to match the existing wall.

4. Wet the mortar joint. What is the purpose of this step?

____

5. Replace the mortar using a tuck point trowel.

6. Finish the joint to appear uniform with the surrounding joints.

7. After the mortar has had time to set, brush the excess mortar from the face of the bricks.

8. Clean and place the tools in their proper storage area.

NOTE: The instructor will provide necessary instructions concerning finished project. Some walls will be left standing and others will be disassembled and block or bricks cleaned and stacked in the storage area.

APPLYING WATERPROOFING AND DAMPPROOFING MATERIALS

OBJECTIVE

Using information and materials provided, apply dampproofing and waterproofing materials to masonry structures. The surface must be 75% covered. Instructor assistance may be provided for most parts of the task.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-II-4	1/student
WB J3ABR55231 000-II-4-P2	1/student
Brush	1/student
Waterproofing materials	1/12 students

MISSION I

PROCEDURE

Using information and materials provided, apply dampproofing and waterproofing materials to masonry structures. The surface must be 75% covered. Instructor assistance may be provided for most parts of the task.

1. Inspect the area to be waterproofed.

2. Where would you normally expect to find waterproofing materials applied? ______________________________

3. Clean the area to be treated.

4. Prepare the dampproofing material.

5. Brush or roll-on the dampproofing materials.

6. Check the completed work.

NOTE: To be effective the complete surface must be covered with no voids.

7. Waterproofing materials are very difficult to remove from hands and clothing. Therefore, you should wear protective clothing and gloves when applying this material.

J3ABR55231 000-III-1 thru 5

TECHNICAL TRAINING

Masonry Specialist

PLASTER, STUCCO, AND TILE

May 1983

USAF TECHNICAL TRAINING SCHOOL
3770 Technical Training Group
Sheppard Air Force Base, Texas 76311

Designed for ATC Course Use

DO NOT USE ON THE JOB

ATC FORM 214 (JAN 76) OBSOLETES ATC FORMS 214, MAY 69, 522, NOV 63 AND 523, MAY 71. STANDARD COVERSHEET

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Supersedes SGs J3ABR55231 000-III-1 thru 3, November 1981

3770 Technical Training Group
Sheppard Air Force Base, Texas

SG J3ABR55231 000-III-1
May 1983

VULNERABILITIES OF AFSC 552X1 TO OPSEC VIOLATIONS

OBJECTIVE

Given a list of operational activities related to AFSC 552X1, select the activities indicating OPSEC vulnerabilities for AFSC 552X1.

INTRODUCTION TO OPSEC

Since the beginning of our military existence, security has played an important role in the defense of this nation. History oftentimes has shown that wars were won or lost because of the capability of one side to secure secret information on the strategy, or information on top secret equipment of the other side.

Operations Security (OPSEC) can be compared to a puzzle or problem for hostile forces. It's like any problem that needs to be solved, the more aspects of a problem you can identify, the better the chance is of solving it correctly; therefore, the less facts you can gather, the less likely you will be able to come up with a sound answer. So goes it with security, the enemy's problem is to find out what our moves will be, our problem is to prevent them from attaining it. OPSEC is set out to prevent any unauthorized release of information pertaining to the location or movement of military forces or equipment in addition to the function, capabilities and existence of these forces or operations.

ASSIGNMENT

Day 16 - Read and study the following information for directed study, and answer the questions in WB J3ABR55231 000-III-1-P1.

Origin of OPSEC

The first Air Force OPSEC program was developed to deal with the problems presented by the enemy's activities in Southeast Asia operations. OPSEC was designed to prevent the enemy from gaining prior knowledge of our operations.

Definition

Operations Security (OPSEC). The protection of operations through the identification and subsequent elimination or control of intelligence indicators susceptible to hostile exploitation.

Purpose of OPSEC

The purpose of OPSEC is to insure security of military operations during the planning, execution and after-action phases. This is accomplished by denying the enemy information which they could use to decrease our effectiveness or cause an operation to fail. Operations Security Survey is a method used to evaluate the protection afforded a given operation.

Security Threats

Threats to the security of the Air Force are classified into four types. These are sabotage, espionage, subversion, and attack.

SABOTAGE. Sabotage is any act designed to hinder Armed Forces operations. Placing sugar in the gas tank of an Air Force vehicle is just as much as is bombing a missile site.

ESPIONAGE. Espionage is the act of one nation spying on another.

SUBVERSION. Subversion is the act of overthrowing or working to overthrow a government. Also, it is a deliberate attempt to interfere with or impair the loyalty, morale, or discipline of any member of the Armed Forces.

ATTACK. Attack is an offensive action by an enemy group or force, designed to obstruct or delay the mission of an installation.

PROTECTION OF OPERATIONS

Not all security violations are readily recognizable. The potential enemy may gain much more information by observing and analyzing military activities. What is this information which he can use? By gathering and assembling bits and pieces of intelligence data, he has the capability of obtaining information on:

- an increase or decrease in the volume of message traffic.
- submissions of classified or unclassified reports to specific units and command levels.
- special briefings, meetings, and command directives or policies.
- logistic build-up or positioning of support activities.
- starting dates of military operations, nicknames, and delivery deadlines.
- in-commission or out-of-commission rates of the defensive and offensive aircraft or missiles.

What can you do to help? Remember that no matter how small or irrelevant a piece of information may seem, you know that a puzzle is made up of small pieces. Since you will be performing masonry functions all over the base, you will be in contact with classified information about equipment, policies and personnel. Even if you are not the one violating a security precaution, it is still your responsibility to insure it's not done in your presence without attempting to stop it. Report any suspected or known violations to your supervisor, commander or security forces. Without your tireless and continuous vigilant effort to support the OPSEC program, the enemy will be able to get any if not all the pieces he needs to get his puzzle assembled.

Security and You

All members of the Armed Forces, man or woman, and every civilian employee of the U.S. government are potential targets for espionage because each possesses access to information of some value for future purposes, such as a base telephone directory or a map of a missile site. As a general rule, you should not talk about the activities that occur on or off base. A small bit of information could lead to a disaster or even death. This does not include talking with your supervisor about construction plans for a specific area such as a weapons storage area or a new command post. It does preclude you from talking with your next door neighbor about it though.

SITUATIONS YOU SHOULD REPORT. It is your responsibility as a member of the Air Force to report situations involving possible or actual security violations, situations you should report without delay. AF Regulation 205-57 states you are required to notify your Commander of the Air Force Office of Special Investigations (AFOSI).

* Any incident in which you are asked for defense information by any unauthorized person, regardless of that person's nationality.

* Any action by individuals, organizations, or foreign governments which you believe may be contrary to the interests of the U.S. Air Force and/or our Government.

* Any actual or attempted act of sabotage.

* Any attempt to solicit information that could be of intelligence value.

* Any incident in which you or your dependents are contacted by a citizen of a country that is hostile to our country, regardless of whether or not defense information or classified information was discussed.

ACTION YOU SHOULD TAKE. If you ever have reason to believe that an act of sabotage, espionage, subversion, attack, or threat is being made on the President's life or that you are a target for attempted espionage, you are required by AFR 205-57 to notify your Commander or the AFOSI as soon as possible. Do not take any action that will disturb the relationship between the people that are involved in the situation you are reporting. Do not discuss the situation with anyone else. The conscious or deliberate failure of any Air Force member or civilian government employee to report a situation that involves possible or actual security violations may be grounds for appropriate disciplinary actions.

SUMMARY

Operations Security is the protection of operations resulting from the identification and elimination or control of intelligence information susceptible to hostile exploitation. The purpose of OPSEC is to prevent the disclosure of intelligence information that can be used to reduce the effectiveness of military operations.

REFERENCE

AFR 55-30, Operations Security

CIVIL ENGINEERING ORGANIZATION

OBJECTIVES

Given a chart of the CE organizational structure and a list of CE functions, describe the mission, organization, functions and responsibility of a civil engineering organization.

Given information, identify responsibilities and procedures for security and accountability of CE property.

Given information, describe the organization of the structural/pavements career field.

Using information provided, describe the duties and responsibilities of AFSCs 55231/51 and the requirements for career ladder progression.

INTRODUCTION

You have been selected to serve in the Civil Engineering Structural career field. Also, you have been selected to become a Masonry Specialist, which is one of the many job specialities contained in this career field. This selection by the Air Force has opened the door for you to an interesting and profitable experience. This study guide will cover information on the CE organizational structure, property responsibility and accountability within CE, the organization of the structural pavements career field and the duties and responsibilities of AFSCs 55231/51 and the requirements for career ladder progression.

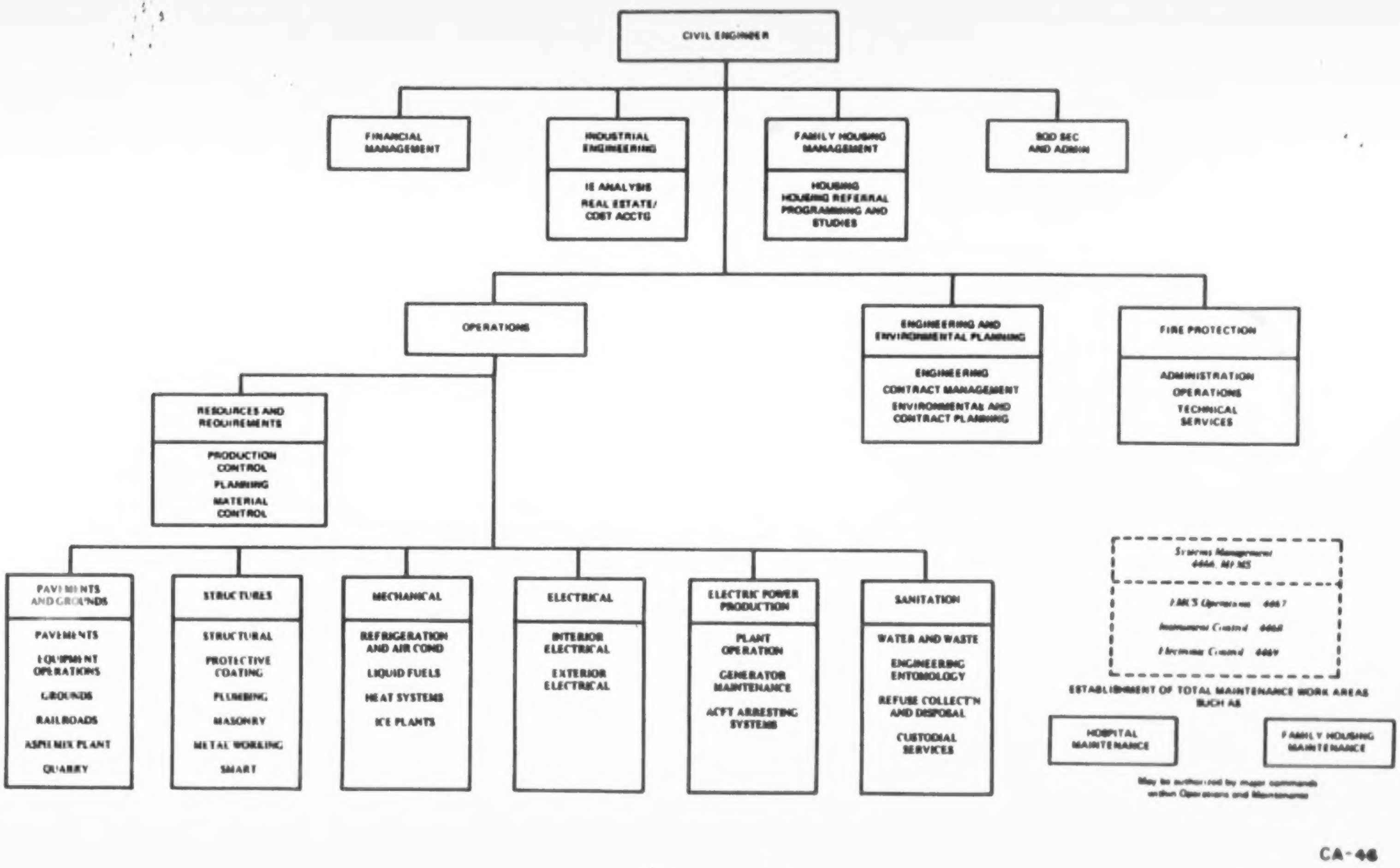
INFORMATION

BASE CIVIL ENGINEERING ORGANIZATION

The base civil engineering organization is responsible for the purchase, construction, maintenance, and operation of the base real property facilities. It is responsible for such activities as construction and maintenance of buildings, building and maintenance of roads and lawns, operation of water supply facilities, provision of fire protection, and even the responsibility for the control of insects and rodents. The officer who commands the base civil engineering organization is the Base Civil Engineer or BCE. The BCE plans, supervises, directs, and coordinates the operation and maintenance of the real property of the base. Other areas under the BCE are the purchase and disposition, accountability and inventory, and the design and construction of facilities. Some of the other responsibilities of the BCE include traffic engineering, utilities and services, structure and aircraft fire protection, recovery from damage or destruction from enemy attack or natural disasters using Prime BEEF forces and the support of tenant organizations and facilities.

BEST COPY AVAILABLE

Base Civil Engineer Organization Chart


CIVIL ENGINEER
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FAMILY HOUSING MANAGEMENT
HOUSING
HOUSING REFERRAL
PROGRAMMING AND STUDIES
SQD SEC AND ADMIN
OPERATIONS
ENGINEERING AND ENVIRONMENTAL PLANNING
ENGINEERING
CONTRACT MANAGEMENT
ENVIRONMENTAL AND CONTRACT PLANNING
FIRE PROTECTION
ADMINISTRATION
OPERATIONS
TECHNICAL SERVICES
RESOURCES AND REQUIREMENTS
PRODUCTION CONTROL
PLANNING
MATERIAL CONTROL
PAVEMENTS AND GROUNDS
PAVEMENTS
EQUIPMENT OPERATIONS
GROUNDS
RAILROADS
ASPH MIX PLANT
QUARRY
STRUCTURES
STRUCTURAL
PROTECTIVE COATING
PLUMBING
MASONRY
METAL WORKING
SMART
MECHANICAL
REFRIGERATION AND AIR COND
LIQUID FUELS
HEAT SYSTEMS
ICE PLANTS
ELECTRICAL
INTERIOR ELECTRICAL
EXTERIOR ELECTRICAL
ELECTRIC POWER PRODUCTION
PLANT OPERATION
GENERATOR MAINTENANCE
ACFT ARRESTING SYSTEMS
SANITATION
WATER AND WASTE
ENGINEERING ENTOMOLOGY
REFUSE COLLECT'N AND DISPOSAL
CUSTODIAL SERVICES
Systems Management 4466, MFMS
EMCS Operations 4467
Instrument Control 4468
Electronic Control 4469
ESTABLISHMENT OF TOTAL MAINTENANCE WORK AREAS SUCH AS
HOSPITAL MAINTENANCE
FAMILY HOUSING MAINTENANCE
May be authorized by major commands within Operations and Maintenance
CA-46

Figure 1. Base Civil Engineer Organization Chart

Figure 1 shows the layout of a typical base civil engineer organization. The organization to which you will be assigned will be either a civil engineering group or a civil engineering squadron. In most cases, assignments are made to squadrons since groups are not too common and are found only on the larger bases. In any case the civil engineering organization is commonly referred to simply as "CE".

CE FUNCTIONS AND RESPONSIBILITIES

Now let's take a closer look at the organization and their responsibilities.

The typical base civil engineer organization chart in Figure 1 shows that there are seven major functional sections: Financial Management, Industrial Engineering, Family Housing Management, Squadron Section and Administration, Fire Protection, Engineering and Environmental Planning, and Operations. Let's review the main responsibilities of these seven sections.

FINANCIAL MANAGEMENT. This section, shown at the top left corner of Figure 1, serves as an advisor to the BCE. Develops, prepares, submits, and maintains the financial plan and budget estimates.

INDUSTRIAL ENGINEERING. This section, shown at the top left center of Figure 1, serves as a consultant to the BCE and staff for developing improvements to management systems. Evaluates the quality of service provided to CE customers and serves as technical consultant to the BCE on real estate and real property matters.

FAMILY HOUSING MANAGEMENT. This section, shown at the top right center of Figure 1, serves as a source for housing referrals (list of off base housing available in the area), manages all base housing, conducts housing studies, and programs military housing construction.

SQUADRON SECTION. This section, is shown at the top right corner of Figure 1. You are probably already familiar with the duties of personnel in the squadron section because this section handles the administrative work of the CE organization. The administrative section receives, distributes, and dispatches communications for CE; prepares reports and correspondence, maintains correspondence files; maintains the CE library; conducts special programs, drives, and awards; and supervises the recordkeeping and preparation of reports for the cost reduction program.

The squadron section also takes personnel actions that are given to it by the squadron commander. These actions include counseling, maintaining duty rosters, conducting general military training and commander's call, and enforcing discipline.

FIRE PROTECTION. This section, shown in Figure 1, administers fire protection programs and performs fire control services. It also inspects and tests fire protection and fire alarm systems, and services ground-type portable fire extinguishers.

ENGINEERING AND ENVIRONMENTAL PLANNING. This section in Figure 1, is staffed with architectural and professional engineers. Problems arising which are beyond the capability of operations and maintenance personnel are referred to the engineers in this section. Personnel of this section also review and develop technical provisions of contracts for real property facilities. Personnel of this section are also responsible for insuring that all present and future uses of the base do not endanger the natural resources as well as the quality of the living and working environment.

OPERATIONS. This section, shown in Figure 1, directs all work that will be done by each work center. To assist the Chief of Operations in directing these work centers is the Resources and Requirements Section. This section identifies, receives, processes, and plans work to be accomplished by CE. They also order, receive, and deliver materials required for job completion.

The major work areas (shops) under Operations, shown in Figure 1, are Pavements and Grounds, Structures, Mechanical, Electrical, Electric Power Production, and Sanitation. Each of these areas may contain several work centers. For instance, the Structures area, where you will likely work, has structural (carpentry), protective coating, plumbing, masonry, metal working, and a structural maintenance and repair team (SMART). Sometimes there are variations if there is no need for a particular activity.

Natural Disaster and Combat Support

"When the whistle blows, are we ready to go?" This was the question asked by the Director of CE Operations, HQ USAF in December 1963.

The answer was "No". However, under project "Prime BEEF" the answer is now "Yes". Project "Prime BEEF" created within the peacetime Air Force civil engineering force, the capability to perform direct combat support tasks in support of worldwide contingency operations. The contingency operation may be in response to war, hostile aggression, natural disaster or catastrophe.

The role of civil engineering has changed a lot since World War II. Civil engineering now has a direct combat support role. If you are selected to be a member of one of the Base Engineer Emergency Force teams, you must train to become more involved in contingency operations. In normal BCE work, you will be a member of a BEEF Team and be trained and prepared to go with that team on very short notice. You, as a masonry specialist, must know how to build field facilities, such as mess halls, showers, and latrines.

In addition, you must have the know-how and have the ability to protect the facilities from enemy action. Your ability to support direct combat operations in these ways is the only reason for you wearing a military uniform during your normal peacetime duties.

Prime BEEF means "Base Engineer Emergency Forces". This type of force is made up of selected airmen and officers at bases throughout the United States. The personnel are members of units within the force called Prime BEEF teams. In the event of an enemy attack, a natural disaster, or an emergency work load, at either a stateside or an overseas base, a BEEF team can be made available to supplement the work force at the affected base. There are a number of Prime BEEF teams. At this time, however, you should become knowledgeable in the six major objectives of the Prime BEEF program.

Objectives of Prime BEEF. The following are the six major objectives of project Prime BEEF, as taken from AFR 93-3. The Prime BEEF Program:

(1) Alignment of the civil engineering military force to perform direct combat support tasks in support of the Air Force mission worldwide.

(2) Develop and maintain a highly skilled mobile military engineering force capable of rapid response for direct combat support of worldwide contingency operations.

(3) Insure effective use of the civilian engineering force in meeting requirements generated as a result of natural disasters and in response to indirect combat support needs.

(4) Provide supplementary training as necessary to insure military personnel are capable of performing tasks peculiar to direct combat support operations.

(5) A balanced military-civilian mix providing equitable career development opportunities for both military and civilian personnel.

(6) An adequate military manning to support Air Force rotation requirements.

Operation Concepts. The Prime BEEF program is structured to provide the following teams: BEEF C, F, RR, M, and augmentation teams. In addition, the Continental United States (CONUS) assigned personnel provide the military resource of trained personnel to satisfy Air Force contingency and rotation requirements on a worldwide basis.

Contingency Team (BEEF-C). This team supports unforeseen contingencies and special air warfare operations, but is not attached to a specific air unit. There are several BEEF-C teams located throughout the Air Force. Headquarters USAF retains unilateral authority to deploy these teams, or any part of them, whenever required. These teams are normally deployed in TDY status usually for not more than 179 days.

Flyaway Team (BEEF-F). There are also several BEEF-F unit in CONUS. They are attached to the Tactical Air Command (TAC) or Military Airlift Command (MAC), and move with and support those flying units whenever they are deployed. One important aspect of the flyaway team is that HQ TAC or MAC may direct deployment of an "F" unit from another command's base on which it is a tenant.

Missile Team (BEEF-M). The 'M' team provides organization and depot level maintenance for real property installed equipment. If missiles are fired, these teams are available for deployment, unless the pad is to be recharged. There is no prescribed manning quota in this area. Therefore, manning for BEEF-M teams coincides with current authorizations.

Rapid Runway Repair Team (BEEF RR). This team is a specialized engineering team capable of deployment within 72 hours to provide temporary, quick repair of runways. Heavy equipment necessary to complete this task may also be deployed if necessary.

Augmentation Team. These teams are structured within specific skill areas; i.e., vertical construction, horizontal construction, electrical, mechanical, water and sanitation, etc. The purpose of such teams is to provide large skill blocks to assist or augment BEEF C or F teams or in-place overseas theater teams in satisfying unique contingency requirements.

Away from the typical base civil engineering organization or CE squadron are "RED HORSE" squadrons. These Red Horse squadrons have the ability to repair major damage that may be inflicted upon a base, or to do heavy construction. The name is "RED HORSE" is an acronym. This means that the letters in the name represent words. RED means "Rapid Engineer Deployable". HORSE means "Heavy Operations Repair Squadron, Engineer". When you put it all together, RED HORSE means "Rapid Engineer Deployable Heavy Operation Repair Squadron, Engineer". Try telling your friend the title of that unit. It's a mouthful, isn't it? It's like McDonald's hamburger on a sesame seed bun. "RED HORSE" is so much easier for you to say. The title, however, explains to a large extent, the function of the unit.

RED HORSE squadrons provide heavy repair and construction of horizontal and vertical base facilities when and where the requirements exceed the base CE's capabilities and when the work meets the mission given to RED HORSE by the Department of Defense. These squadrons are formed with trained personnel from all major commands. The men are given training to make them proficient in all areas of their skills. The training is necessary to meet the high standards required of men in RED HORSE squadrons. RED HORSE squadrons are capable of rapid deployment and are responsibe to the following:

- Worldwide requirements as directed by Headquarters USAF.
- USAF tactical forces deployed in conjunction with war or the likely event of war.
- Establishment of new base facilities or the expansion and upgrading of existing base facilities.
- Meeting recovery requirements for Air Force facilities in case of natural disasters.
- Training exercises, maneuvers, and special projects.

RED HORSE also makes major construction alterations and additions to an existing base, as would be the case when a runway is lengthened, a hangar is built, or aircraft parking ramps and taxiways are constructed.

The RED HORSE squadron can move on to an abandoned air base and restore it to the extent necessary for flying operations. Likewise, the squadron can move into an area where there has never been a base and build one.

PROPERTY ACCOUNTABILITY AND RESPONSIBILITY

It is important that you understand your responsibility for Government property, because there may come a time when the Air Force will ask you to pay for a piece of equipment that is lost.

Your knowledge of the rules and procedures will not only help you to care for and safeguard this property, but, in many instances, will relieve you from monetary responsibility for its damage or loss. The property that you use in the performance of your duties, whether it is a desk, a typewriter, a truck, a trowel, or a grinding machine, is your responsibility. One aspect of good management is the principle that the person who is using the property is responsible for its care.

In an organization as large and complex as the Air Force, a method of assigning responsibility for property is absolutely necessary. Otherwise, we could never be sure that property would be adequately safeguarded and the whole system would lend itself to waste and carelessness. But where does responsibility originate?

Supply discipline must start with each individual of the Air Force regardless of assignment. This applies to all civilian and military personnel, whether or not on active duty. Each person is charged by law with the proper custody, care, and safeguarding of all Government property under his jurisdiction regardless of whether or not he has signed a receipt for it. Property issued to individuals does not become private property but remains the property of the Government. It must be properly used, cared for, and safeguarded. This is because the money used to buy property comes from all of us in the form of taxes. The title to this property is not held by any one individual because it is jointly owned by all of us. Congress has the responsibility of appropriating the money to buy this property; so we look to Congress for the law to hold an individual or individuals responsible for public property.

Congress passed such a Federal law in March 1894. This law is the authority for making regulations concerning responsibility for public property. The Air Force explains the application of this law in AFR 67-10, Responsibility for Management of Public Property in Possession of the Air Force.

Responsibility for Public Property

When you buy an article from a store, the moment the sales clerk completes the transaction the store drops its accountability. It then becomes your property and your accountability and responsibility for whatever use you make of it. Similarly, when a stock clerk issued an AF item to you, accountability is dropped insofar as the issuing authority is concerned. However, you do not become the owner of the item; instead, the Air Force retains ownership, and you assume responsibility for the care and protection of the item.

Certain officers, airmen, and civilian employees are designated as supervisors. As such, they directly supervise the people who are users of Air Force property and who are responsible for carrying out the orders and directives of the commander. As representatives of the commander, the supervisors have certain responsibilities for subordinates and property. However, if they are supervising several workers, they cannot be looking over the shoulder of each worker at all times. Therefore, like the commander, the supervisors cannot be made completely responsible for the property in their activities.

Command Responsibility

The organizational commander is responsible for all property issued to his organization, whether he signs for it or not. But because the duties of the commander make it impracticable for him to exercise personal supervision of the supply functions, a commander designates an officer to act as his supply officer. The commander or his supply officer may then designate other representatives to receive and sign for property in his name. However, delegation of duty does not make the commander exempt from financial liability for loss, damage, or destruction of property.

SUPERVISORY RESPONSIBILITY. Supervisory responsibility applies to any person who exercises supervision over property received, in use, in transit, in storage, or undergoing modification or repair. The supervisor is responsible for selecting qualified personnel to perform the duties under his control and for properly directing or training them. He instructs them in supply procedures in order to insure compliance with Air Force regulations governing property. The supervisor is also responsible for indoctrinating his men in the principles of supply discipline.

CUSTODIAL RESPONSIBILITY. Any individual who has acquired possession of Government property has custodial responsibility for it. He is personally responsible for such property if it is issued for his official or personal use, whether or not he has signed a receipt for it. He is also personally responsible for any property under his direct control for storage, use, custody, or safeguarding.

"Finders, keepers" may apply in some circumstances, but not to Government property. If you find Government property that has apparently been lost, stolen, or abandoned, you must assume custodial responsibility for it and protect or care for it until it can be returned to the proper authorities. Personnel may be relieved of responsibility for a particular piece of property in a number of ways, depending on the circumstances. For example, property may be turned back to Base Supply as excess to the unit's needs. Other items may be transferred from the responsibility of one person or organization to another. Still other items may be damaged or lost through carelessness of the one having custody, in which case, he may be held liable and have to pay for them by deductions from his paycheck.

PECUNIARY LIABILITY: Another word for pecuniary liability is monetary. Personnel having property responsibility also have pecuniary liability. The definition of which is to make good the loss, damage, or destruction or property caused by unauthorized use, gross negligence, willful misconduct, or deliberate unauthorized use. Pecuniary liability may be shared in any particular case by persons having command, supervisory, or custodial responsibility. If a person pays for an item of Government property, the property remains the possession of the Government. This keeps the supply system from becoming a source of supply for individual personnel.

AIRMAN STRUCTURAL/PAVEMENTS CAREER FIELD (55)

The Airman Structural/Pavements Career Field includes construction and maintenance of structural facilities and pavement areas. It includes maintaining pavements, railroads, and soil bases, performing erosion control, and operating heavy equipment. The structural area includes carpentry, masonry, metal fabricating, protective coating, and plumbing construction and maintenance. This career field also includes the site development, general maintenance, real estate-cost-management analysis, and programs and work control functions.

The Airman Structural/Pavements Career Field is a contingency-related field and personnel serving in this career field are subject to deployment and should have knowledge of contingency skills such as first aid procedures, field sanitation and hygiene, work party security, and expedient field methods.

Everyone in the Structural/Pavements career field is identified by the first two digits of their AFSC. Whether it is a masonry specialist with the AFSC 55251 or a construction equipment operator with the AFSC 55151.

Now let's take a closer look at your career field in the Structural/Pavements career field as shown in Figure 2. This career field chart shows how each AFSC progresses. To advance up you will require training and rank and this is what will be covered next.

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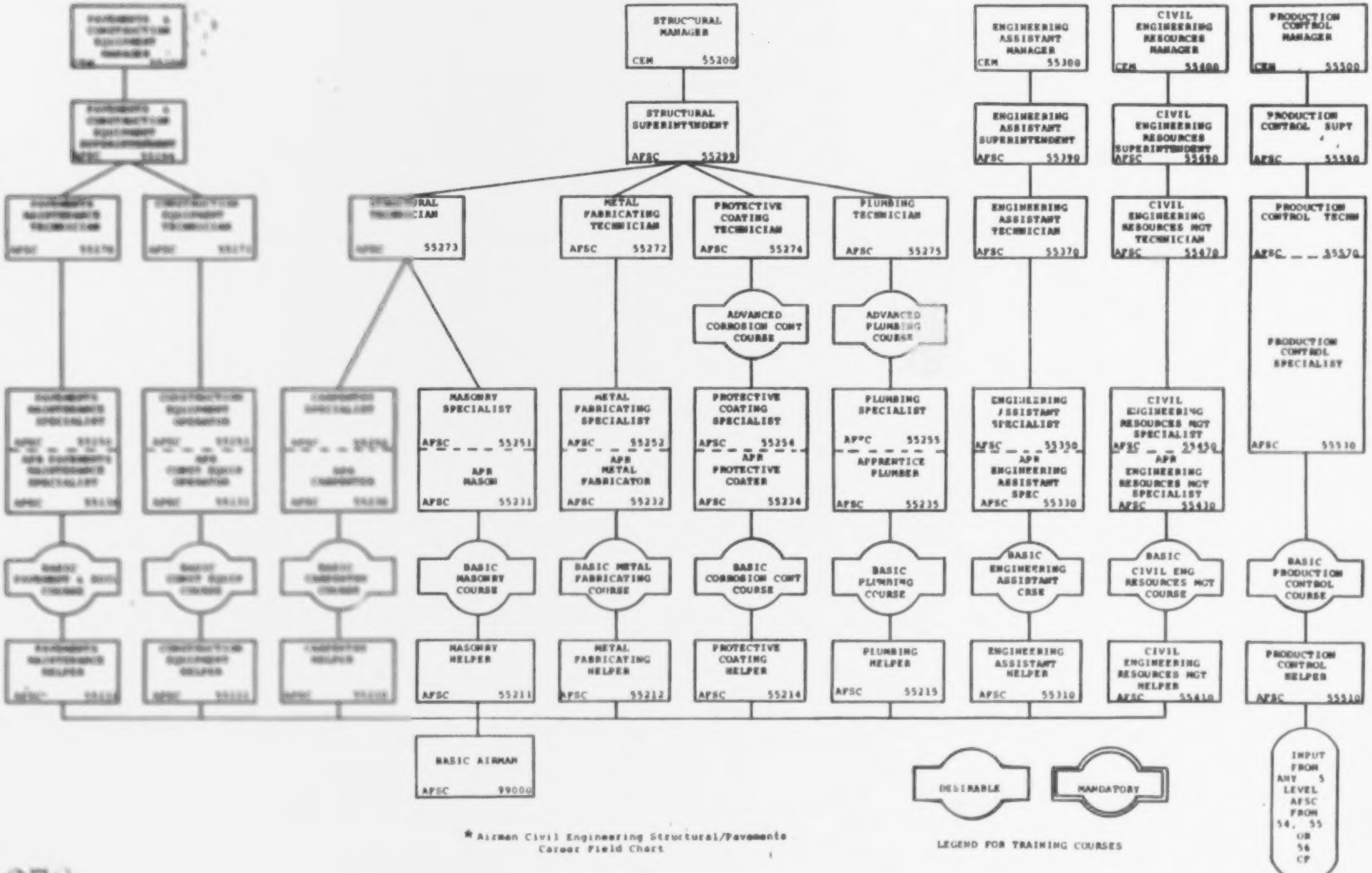
STRUCTURAL MANAGER
CEM 55200
STRUCTURAL SUPERINTENDENT
AFSC 55299
ENGINEERING ASSISTANT MANAGER
CEM 55300
CIVIL ENGINEERING RESOURCES MANAGER
CEM 55400
PRODUCTION CONTROL MANAGER
CEM 55500
ENGINEERING ASSISTANT SUPERINTENDENT
AFSC 55390
CIVIL ENGINEERING RESOURCES SUPERINTENDENT
AFSC 55490
PRODUCTION CONTROL SUPT
AFSC 55590
STRUCTURAL TECHNICIAN
AFSC 55273
METAL FABRICATING TECHNICIAN
AFSC 55272
PROTECTIVE COATING TECHNICIAN
AFSC 55274
PLUMBING TECHNICIAN
AFSC 55275
ENGINEERING ASSISTANT TECHNICIAN
AFSC 55370
CIVIL ENGINEERING RESOURCES MGT TECHNICIAN
AFSC 55470
PRODUCTION CONTROL TECHN
AFSC 55570
ADVANCED CORROSION CONT COURSE
ADVANCED PLUMBING COURSE
PRODUCTION CONTROL SPECIALIST
AFSC 55530
MASONRY SPECIALIST
AFSC 55251
APR MASON
AFSC 55231
METAL FABRICATING SPECIALIST
AFSC 55252
APR METAL FABRICATOR
AFSC 55232
PROTECTIVE COATING SPECIALIST
AFSC 55254
APR PROTECTIVE COATER
AFSC 55234
PLUMBING SPECIALIST
AFSC 55255
APPRENTICE PLUMBER
AFSC 55235
ENGINEERING ASSISTANT SPECIALIST
AFSC 55350
APR ENGINEERING ASSISTANT SPEC
AFSC 55330
CIVIL ENGINEERING RESOURCES MGT SPECIALIST
AFSC 55450
APR ENGINEERING RESOURCES MGT SPECIALIST
AFSC 55430
BASIC MASONRY COURSE
BASIC METAL FABRICATING COURSE
BASIC CORROSION CONT COURSE
BASIC PLUMBING COURSE
BASIC ENGINEERING ASSISTANT CRSE
BASIC CIVIL ENG RESOURCES MGT COURSE
BASIC PRODUCTION CONTROL COURSE
MASONRY HELPER
AFSC 55211
METAL FABRICATING HELPER
AFSC 55212
PROTECTIVE COATING HELPER
AFSC 55214
PLUMBING HELPER
AFSC 55215
ENGINEERING ASSISTANT HELPER
AFSC 55310
CIVIL ENGINEERING RESOURCES MGT HELPER
AFSC 55410
PRODUCTION CONTROL HELPER
AFSC 55510
BASIC AIRMAN
AFSC 99000
INPUT FROM ANY 5 LEVEL AFSC FROM 54, 55 OR 56 CF
DESIRABLE
MANDATORY
LEGEND FOR TRAINING COURSES
* Airman Civil Engineering Structural/Pavements Career Field Chart

Figure 2. Airman Civil Engineering Structural/Pavements Career Field Chart

CAREER LADDER PROGRESSION

You have had a chance to see that a civil engineer organization requires a variety of professional people and tradesmen to operate and maintain the many facilities for a base, each with specific jobs to perform.

These jobs fall into distinct categories called Air Force Specialty Codes (AFSCs). The different categories are identified by numbers. Each number of the code has a meaning. Figure 3 explains the breakdown of AFSC 55231. You will be awarded AFSC 55231 when you acquire the knowledge provided by this course and learn the skills through on-the-job training.

First Two	55	Career Field	Airman Civil Engineering Structural/Pavements
Third	2	Career Field Subdivision	Structural
Fourth	5	Skill Level of AFS	Skilled Level
Fifth	1	Specific Air Force Specialty	Mason

Figure 3. AFSC 55231 Breakdown

When you entered this school, you were a masonry helper, AFSC 55211 perhaps, you have already progressed from an Airman Basic (AB) to an Airman (AMN) or even an Airman First Class (A1C). When you complete this course you will climb one step to an apprentice mason, AFSC 55231. Then upon your arrival at your next duty station, you will be entered into a dual channel training program for your 5-skill level. Only after you have completed all the requirements of the training program will you be upgraded to the 5-skill level in your AFSC. After you earn the AFSC 55251 Masonry Specialist, and you are promoted to SSGT (E-5) you will again be placed in a dual channel training program for the next level, structural technician AFSC 55273. Notice in Figure 3 that the carpentry and the masonry career fields merge at the 7 level.

To be awarded a 9 level (AFSC 55299), you must be a Master Sergeant, spend at least 1 year as a Master Sergeant, and pass the Air Force Supervisory Exam. You should know that there is no skill knowledge required other than the Supervisor's Exam. It would be extremely difficult for a 9 level to know everything from five (5) different career fields. His job is to manage those shops under his control, relying upon the knowledge of the shop foremen to handle the technical problems that come up.

The requirements to be awarded CEM 55200 Structural Manager, are to be a 9 level with the AFSC 55299 Structural Superintendent and be promoted to Chief Master Sergeant. If you work hard, study and do your best, you can expect to climb up the career field ladder from a 55211 to a 55299 or 55200.

UPGRADE TRAINING

There are two (2) ways to be upgraded in skill level. The first of these ways is the way that you are getting your 3 level. This is formal technical training. This type of training is sometimes used to award either a 3, 5, or 7 level AFSC. In our AFSC only the 3 skill level can be obtained by formal training.

The next type of training is the type that is the most commonly used. This is a dual channel, or two-part program consisting of OJT (On-the-Job Training) and CDC (Career Development Course). This program makes use of time spent on the job work with skilled masons learning how to do the work with the knowledge that you learned through self-study. This type of training is the type that you will use for upgrading to the 5 skill level; and, when you make Staff Sergeant, you receive this type training for upgrade to the 7 skill level.

The completion of the CDC (knowledge) portion of the program is very important. Most of you have hopes of becoming an E-4, and the only way that this can be done is to possess a 5 level. You cannot be promoted to E-4 without it. Upon arrival at your next duty station, one of the first things the squadron will do is enter you into OJT for your 5 level. The CDC portion of your OJT consists of two (2) volumes that are self-study. You have an open book test at the end of each volume; and, if you pass these, you will be scheduled to take the final exam at the Base Testing Office. After this is done and if you pass this test, which you should, there are two (2) other things needed to give you a 5 level. One of these is your supervisor saying that you have acquired the skills required and the other is having spent six (6) months on OJT. When all these have been accomplished, the paper work will be started to get you your 5 level. You notice that it takes six (6) months in training to get your 5 level, but you can complete your CDC course in about (2) to three (3) months. It would be to your advantage to get this portion out of the way as quickly as possible. This will allow you to place all your effort on improving your job skills.

The process for being awarded a 7 level (AFSC 55273) is basically the same as for the 5 level. The minimum time to get a 7 level increases to one (1) year. You must be a Staff Sergeant. You have the added knowledge of the Carpentry Career Field, AFSC 55250, due to our combining with the carpentry field at the 7 level. You also have to spend times as a supervisor to show that you can supervise other workers and take either a Base Management Course or a CDC Management Course.

To be awarded a 9 level (AFSC 55299), you must be a Master Sergeant, spend at least 1 year as a Master Sergeant, and pass the Air Force Supervisory Exam. You'll notice that there is no skill knowledge required other than the Supervisor's Exam. It would be extremely difficult for a 9 level to know everything from five (5) different career fields. His job is to manage those shops under his control, relying upon the knowledge of the shop foremen to handle the technical problems that come up.

DUTIES AND RESPONSIBILITIES

The duties and responsibilities of the Mason AFSC 55231 Apprentice Mason and the AFSC 55251 Masonry Specialist are the same. But naturally, the performance level and the task and subject levels for the specialist are higher than they are for the apprentice worker. This means that the 5 skill level mason is more proficient in skill than a 3 skill level mason. It does not mean that he will work any harder than the apprentice or even be smarter than the 3 skill level. The duties and responsibilities for each AFSC are outlined in AFR 39-1 Enlisted Personnel Airman Classification. Figure 4 shows a 39-1 for AFSC 55231/55251 and Figure 5 shows a 39-1 for AFSC 55273.

SUMMARY

The Civil Engineering Organization has the responsibility of operating and maintaining all real property. We, who are part of Air Force Civil Engineers, must be aware of the tremendous costs involved. We must do all we can to conserve dollars and make our labor economical for the operation and maintenance of this real property.

Property responsibility is the obligation of each individual for the proper care of property belonging to the Air Force, whether or not such property has been issued to him or his unit. Such responsibility includes pecuniary liability.

You have seen where your job will be located within Civil Engineers and what jobs are required of you as a mason. You can see that as you gain in rank in the Air Force, you also have to gain additional knowledge to go along with the rank. Along with the rank knowledge your duties and responsibilities will also increase.

AFSC 55251
Semiskilled AFSC 55231
Helper AFSC 55211

AIRMAN AIR FORCE SPECIALTY

MASONRY SPECIALIST

1. SPECIALTY SUMMARY

Constructs, maintains, and repairs masonry and concrete buildings and structures. *Related DOD Occupational Subgroup:* 710.

2. DUTIES AND RESPONSIBILITIES

a. *Forms structures of concrete.* Advises carpentry specialists in placement and building of forms. Constructs concrete footings, foundations, floor slabs, piers, and columns for prefabricated steel structures. Installs anchors and structural and reinforcement steel, such as bars, stirrups, spacer rods, and mesh, by bending and spacing according to specifications in design drawings, blueprints, sketches, and so forth. Places concrete into forms and uses concrete working tools, such as vibrators, floats, straight edges, templates, and other devices. Cures concrete in structures, using water, sand, fabric, paper, and chemical mixtures. Installs and maintains rock bolts.

b. *Lays brick, building block, stone, and other materials including ceramic and quarry tile.* Lays material to form structures in accordance with blueprints, building plans, or other directives. Cleans surface and prepares bed for mortar. Cuts, trims, faces, and surfaces masonry materials to proper size and shape, using masonry tools such as power saws, napping hammers, chisels, and brick layer's hammers. Positions masonry materials, using trowel, hammer, mallet, and crowbar. Checks horizontal and vertical alignment, using mason's spirit level and plumb bob. Shapes mortar joints between courses with pointer or trowel point. Seals openings, using sealers oakum and cauling compound. Waterproofs and dampproofs walls extending into wet soil by applying compounds such as bituminous mastic, cement plaster, and metallic powder. Estimates man-hours and materials needed to accomplish work assigned.

c. *Prepares mortar and concrete.* Determines types of mortar or concrete required and prepares material in proportions and amounts required to complete each assignment. Measures aggregates, such as gravel and cement, in proper proportions; adds other ingredients to obtain required consistency; and mixes, using handtools or power mixers. Applies test and analysis data of water and aggregates to mixes.

d. *Plasters interior and exterior of buildings.* Prepares surfaces and applies plaster to walls and ceilings, assuring neat and smooth finish. Finishes and floats surfaces to obtain finish free from blemishes and float marks. Checks all corners, angles, and horizontal edges to ensure plumb, level finish. Repairs cracks and breaks in plastered surfaces by applying new plaster and matching existent surface, leaving smooth and true surface for other craftsmen.

e. *Cleans surfaces.* Cleans finishes concrete, masonry, or plastered surfaces, using carborundum stone, sand blasting machine, wire brush, or acid treatment.

f. *Maintains equipment and tools.* Performs preventive maintenance, lubricates, and makes minor repairs and adjustments to tools and equipment. Removes concrete and mortar from tools and equipment immediately after using to prevent hardening, and oils all metal parts to prevent rust.

g. *Supervises masonry personnel.* Serves as crew leader of masonry and concrete workers engaged in laying masonry units, forming concrete structures, and plastering interior and exterior surfaces. Instructs subordinates in phases of masonry and concrete construction and repair. Examines work accomplished by others to assure complete and meritorious workmanship; points out to others ways in which to improve quality and efficiency in trade.

3. SPECIALTY QUALIFICATIONS

a. *Knowledge:*

(1) Knowledge of standard nomenclature, types, and sizes of masonry and concrete materials; batching formulas methods of curing concrete, mortar, plaster, and lime mixtures; and use and care of hand and power-driven masonry and concrete tools is mandatory. Possession of mandatory knowledge will be determined according to AFR 35-1.

(2) Knowledge of use and capacity of construction equipment is desirable.

3. SPECIALTY QUALIFICATIONS

a. *Knowledge:*

(1) Knowledge of standard nomenclature, types, and sizes of structural materials; batching formulas and methods of curing concrete, mortar, plaster, and lime mixtures; use and care of hand and power-driven masonry and concrete tools; building maintenance, repair, and construction; nomenclature of woodworking materials; equipment and tests and characteristics pertaining to reinforcing steels and meshes is desirable.

(3) Knowledge of properties of fine wood and processing and molding wood by steaming, laminating, and gluing is desirable.

b. *Experience.* Qualification as a Carpentry Specialist or a Masonry Specialist is mandatory. In addition, methods of storing and chemically treating wood; theory of squaring by equivalent measurement; application of simple mathematics; and use of carpentry and woodworking hand and power tools is mandatory. Possession of mandatory knowledge will be determined according to AFR 35-1.

(2) Knowledge of use and capacity of construction experience in performing or supervising functions such as laying and shaping of masonry units, plastering, and carpentry; or constructing, erecting, and repairing buildings, heavy structures, planning and prefabricated structures is mandatory.

c. *Training.* Completion of prescribed 7-level management course is mandatory.

FIGURE 5 AFR 39-1 FOR AFSC 55273

APPLYING PLASTER AND STUCCO

OBJECTIVE

Using information provided, identify the materials used in processing, mortar and plaster mixes.

Working individually, but as a member of a team and with instructor assistance for most parts of the task, install lath to receive plaster or stucco. The lath must be ready for a scratch coat of plaster.

Working individually, but as a member of a team using masonry tools and with instructor assistance for most parts of the task, mix, test for consistency, and apply a scratch coat of plaster. Surface must be covered with no visible voids and be ready to receive a brown coat of plaster.

Working individually, but as a member of a team and with instructor assistance for most parts of the task, mix, test for consistency, and apply a brown coat of plaster. Surface must be covered with no visible voids and must be ready for a finish coat or to receive tile.

Working individually, but as a member of a team, observing safety procedures and with instructor assistance for most parts of the task, mix, test for consistency, and apply a finish coat. Surface must be covered with no visible voids and have a smooth or textured finish.

Working as a member of a team, using tools provided, and with instructor assistance for most parts of the task, inspect a plastered surface and identify and determine the cause of any damage, then repair the areas bringing them back to within 70% of original condition.

INTRODUCTION

Plaster or stucco is a facing material that is applied to walls and ceilings. Plastering is one of the most ancient arts or trades. A bird nest made of straw and plastered with mud is probably the oldest form of plastering, and researchers have found evidence that primitive man built frameworks of stick which were plastered with mud. Later, plaster of a more lasting material was developed to replace the mud. The tools that are used by the early plasters closely resemble those used by the tradesman of today.

INFORMATION

Assignment (Days 16, 17, 18, 19) read and study the material covered in this study guide.

Plaster and stucco are applied over a lath or some sort of base. The quality of the job depends considerably upon the type of base that is used for the project. Plaster bases have changed a lot over the years. The bases used today consist of wood lath, metal lath, gypsum board lath, and any type of masonry. The main criterion for a good base is that is must provide a good key to hold the plaster or stucco on the wall. The illustration in Figure 6 shows wood lath with proper keying of the plaster.

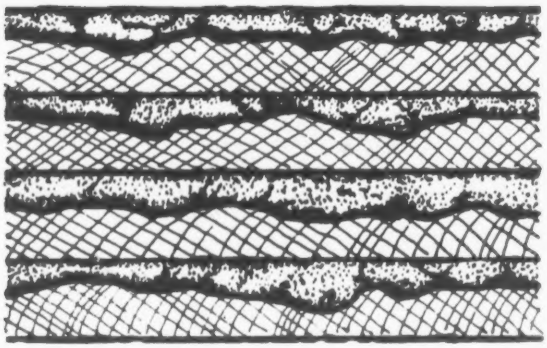

Figure 6. Wood Lath with Proper Keys

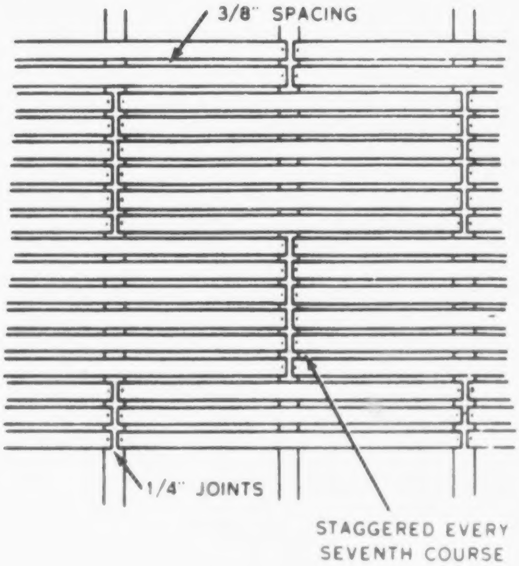

Figure 7. Proper Spacing for Wood Lath

Wood Lath. Wood laths are thin strips of wood, approximately 1½ inches in width, with rough surfaces. They are nailed on wooden studs. The laths are spaced 3/8 inch apart at the edges and 1/4 inch apart at the ends. The ends of the lath should be staggered on the studs to provide a stronger base for the plaster. Figure 7 shows wood laths properly installed. Wood laths must be dampened before plaster is applied, to prevent them from drawing moisture from the plaster.

Metal Lath. There are several different kinds of metal lath available for use for plaster or stucco. The three main types of metal lath are expanded metal lath, woven wire or ribbed lath. Figure 8, 9, and 10 shows each type respectfully. Metal lath is usually 27" X 96" in size. Woven wire comes in rools and is easily cut and fitted. Metal laths should be shop coated (painted) or be galvanized so to protect it and prevent it from rusting.

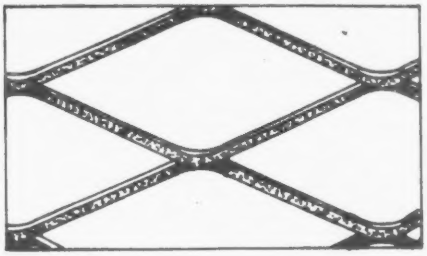

Figure 8. Expanded Metal Lath

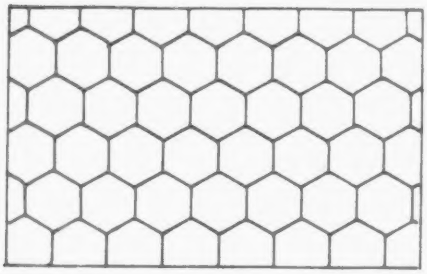

Figure 9. Woven Wire Mesh

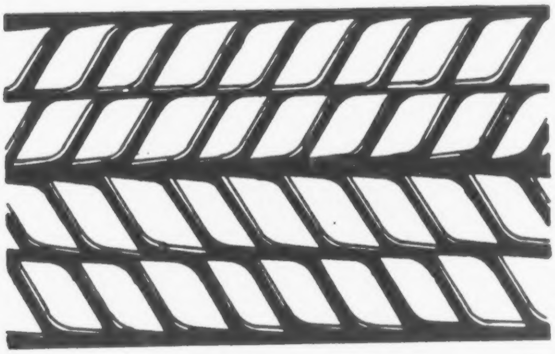

Figure 10. Ribbed Lath

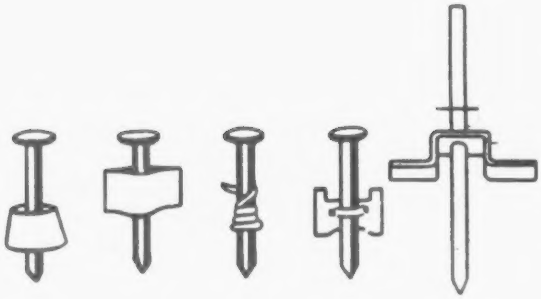

Figure 11. Special Furring Nails

Metal lath attached to an exterior surface is attached with special furring nails, as shown in Figure 11. Otherwise metal lath is nailed in place with 1½" blued or annular ring nails or it is fastened in place with clips. Exterior surfaces that are to receive stucco are first covered with waterproof building paper (tar or felt paper). Then, the metal lath is fastened with the special nails to hold it away from the wall to provide a space for the stucco to form a key.

Corners, both inside and outside must be reinforced with corners of metal lath. A corner lath for interior corners should have a minimum width of 5 inches, or 2½" legs on each side of the angle. If a preformed strip is not available, you can cut one from the metal lath sheets and form it on the job to fit the corner. Corner beads reinforce the external corners and also serve as a guide to assure a uniform thickness when plastering. They are manufactured in two styles, the bullnose bead and the standard bead. The bullnose bead, shown in Figure 12, has a wide radius bead and is designed for corners receiving hard usage. The standard bead, shown in Figure 13 has a very small radius and is designed to provide sharp clean corners. Take care when fastening any type of corner lath. Fasten the corner lath at its edges, using staples over wood or gypsum and tie wires over metal lath. Be sure the corner lath is not fastened by nailing through to the super structure. If it is nailed as such the stresses in the framing will then be transferred directly into the plaster and cause it to crack.

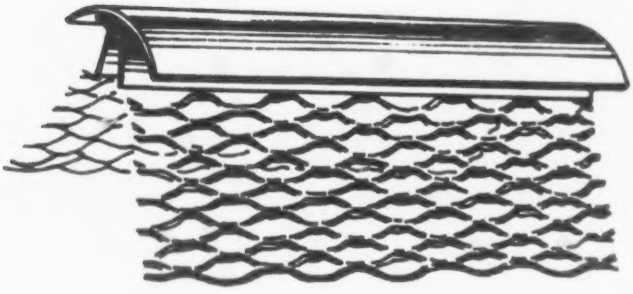

Figure 12. Bullnose Corner Bead

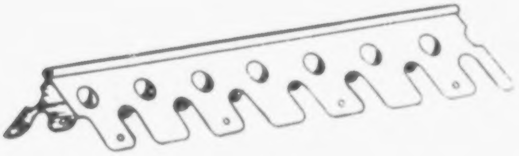

Figure 13. Standard Corner Bead

Gypsum Board Lath. Gypsum board is the most popular plaster base in use today. There are many advantages to this type of base. The most important advantages are that it is faster to install and it provides a better surface for bonding, which results in a smoother finish. Another bid advantage is that it is essentially fireproof.

There are two common types of gypsum board - plain gypsum board and perforated gypsum board. The perforated gypsum board is identical to the plain board except that it has 3/4" holes punched at regular intervals. These perforations enable the plaster to go through the board and form a key to lock itself in place. It is available in sizes of 16", 18" or 24" wide by 48" long and in thickness of 3/8" to 1" thick. It is generally applied horizontally (across) the frame members. For studs and joists with a spacing of 16" on center 3/8" thickness is used, and for 24" on center 1/2" thickness is used. One type of gypsum board has a finish paper face and a rough paper backing, another has a foil backing that serves as a vapor barrier and if the foil side faces an air space, it has some insulating value. The vertical joints should be broken over the studs or joists and staggered. Figure 14 illustrates a gypsum lath wall with staggered spacing and the nails spaced 4" O.C. and nailed to each stud or joint crossing. Gypsum lath may be used with metal clips that are located between the studs or joists to stiffen the horizontal joints.

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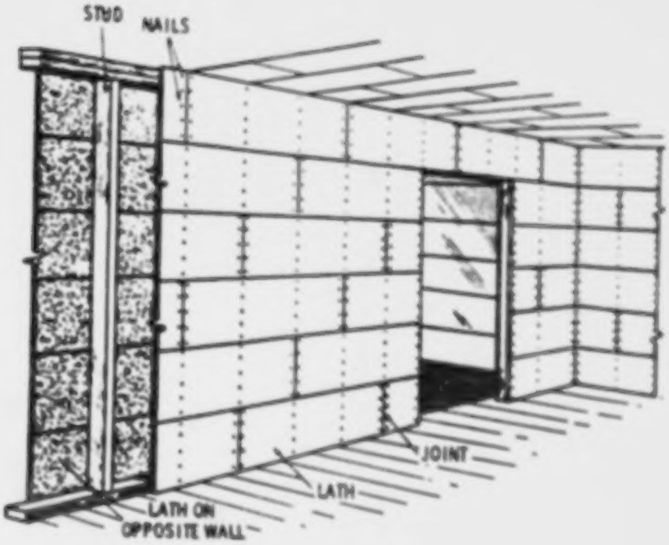

Figure 14. Gypsum Board Lath Installation

Masonry. When you apply plaster or stucco to any type of masonry (brick, block, concrete, etc.), it is essential that a good bond is obtained. Whatever type of masonry is used as the base it must be coarse enough for the plaster or stucco to cling, and be free from paint, oil, dust and dirt. A good bond on a masonry surface is dependent on two factors: mechanical bond and suction.

If a masonry surface is hard and smooth and the plaster or stucco will not bond the surface must be roughened. At least 70% of the masonry surface must be roughened if a good bond is to be obtained. There are several ways you can roughen a masonry surface, one way is to chip the surface with a brick hammer. You can also roughen the surface with a power-driven roughening machine. This machine is equipped with a series of steel cutters mounted to provide a flailing action which results in a scored pattern. Another method of roughening the surface, when working with portland cement plaster, is to apply a dash bond coat.

A dash bond coat consists of one part portland cement and one part sand mixed with the correct amount of water to give the mix an adhesive consistency. To apply this mix, dip a long stiff-fibered brush in the mix and splatter the material on the surface. Allow the material to harden to produce a rough surface.

Never trowel a dash bond coat. Be sure it has set before you apply the plaster. If the dash bond coat fails to give a good mechanical bond, you will have to cover the surface with lath before plastering.

Suction is the amount of moisture the masonry will absorb. This action causes fresh plastering material to stick to the base. You can check a masonry surface for good suction by spraying it with water and observing the reaction of the masonry. If some of the water is not drawn in, it is impossible to obtain a good bond. In this case, you will have to use lath to key the plaster to the masonry.

Weathered masonry surfaces may have too much suction. When you apply plaster to this type of surface, the plaster stiffens quickly and becomes difficult to work. To stop this from happening, spray (not soak) the masonry with several applications of water. It is also important that the suction be controlled uniformly over the entire masonry surface. If you do not wet the surface evenly, some parts of the masonry will draw more moisture from the plaster than others and the final finish may be spotted.

Old masonry that has softened by weathering or surfaces that cannot be cleaned thoroughly must be covered with metal lath. To apply this lath, first nail up furring strips on the masonry. Place the furring strips at 16" O.C., and fasten the metal lath as if it were being fastened to studs or joists. When this is done it adds some insulating qualities due to the air space.

Thickness References. A plaster needs thickness references to work from, these are screeds and grounds. Screeds are strips of plaster, wood, or metal. Corner beads can also serve as screeds. Plaster grounds are used around window and door openings and used along the bottom of a wall. Around the windows and doors they serve as a plaster stop, and as a leveling surface when plastering. They also serve as a fastening surface for the baseboards and the finish trim. Figure 15 shows the placement of screeds on the wall.

PLASTERING TOOLS AND THEIR USES

The tools used today in the plastering trade resemble very closely the tools used ages ago. The only real difference in tools today is that they are more refined. You have probably heard the old adage that you can judge a workman by his tools. This is especially true of a mason. If he does not have the proper tools and know how to use them, he will probably do a shoddy job. The tools used by the mason when plastering are the plasterer's hawk, a variety of shapes and sizes of trowels and floats, the scarifier, the straightedge, and darbies.

Hawk. The plasterer's hawk, as shown in Figure 16, is available in sizes from 10 to 14 inches square. It is used to hold a small supply of plaster. A trowel is used to push plaster from the hawk to the surface being plastered.

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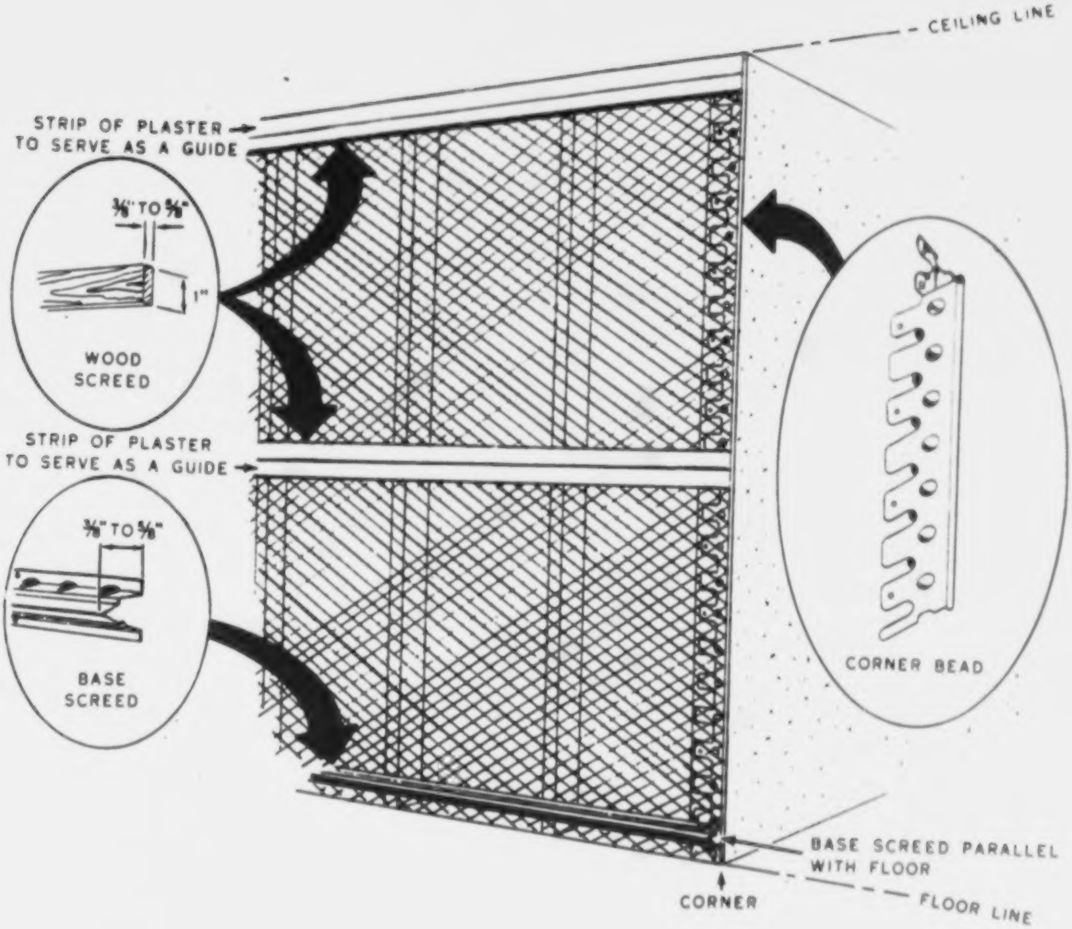
CEILING LINE
STRIP OF PLASTER TO SERVE AS A GUIDE
⅜" TO ⅝"
1"
WOOD SCREED
STRIP OF PLASTER TO SERVE AS A GUIDE
⅜" TO ⅝"
BASE SCREED
CORNER BEAD
BASE SCREED PARALLEL WITH FLOOR
CORNER
FLOOR LINE

Figure 15. Placement of Screeds on a Wall

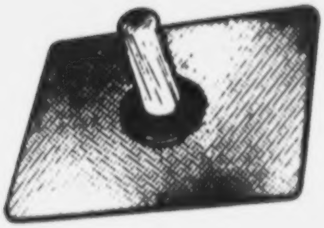

Figure 16. Plasterer's Hawk

Trowel. A variety of shapes and sizes of trowels which you will use for plastering are shown in Figure 17. The panel trowel is used for covering small areas and hard-to-get-at places where the standard trowel would be too large. The angle trowel is a flat-bottomed, two-sided trowel used for smoothing 90° inside corners. The inside-corner trowel is also used for working 90° corners. The margin trowel is used in narrow places, the pipe trowel is used behind pipes, and the pointing trowel is used in small areas and to point up mortar joints.

Float. Different types of floats, as shown in Figure 18, are used for finishing plaster. Some are designed for flat work, while others are for corners or angle work. Smooth-bottomed floats are made of Fiberglass, wood, steel, and other metals. Floats designed to produce textured finishes, such as sand finish, have bottoms made of rubber or carpet.

Scarifier. The scarifier, or scratcher, is used to roughen plastered surfaces so that the next coat of plaster will have a rough surface to cling to. The scarifier is made of tempered steel tines that are flexible. A scarifier is shown in Figure 19.

Straightedge. The straightedge, as shown in Figure 20, is used to level coats of fresh plaster before floating. They are made of aluminum or magnesium alloy. Wood straightedges can be used but require more effort because of their weight.

Darby. The darby is used to float freshly plastered surfaces. At the same time, it eliminates high or low spots left by the straightedge. Some darbies are made of wood, while some are made of metal, as shown in Figure 21.

The other tools involved with plaster work are hammers, tape measures, chalkline's or mason's line, steel square, tinsnips, pliers, a mason's level, etc. These tools are used as and where needed to accomplish the work involved.

MATERIALS USED IN PLASTER OR STUCCO

The composition of the plaster varied somewhat in various localities as it does today. Lime, sand, and gypsum were used by the Egyptians and Greeks as a finishing material, but it had such a slow rate of set that it took weeks or months to complete a job. It took as long as two or three weeks for each coat to set; therefore, it became necessary to develop better materials to decrease this time. Today, additives to plaster have decreased the setting time to a matter of days, allowing the plasterer to build up coats to the required thickness and finish in a matter of days rather than weeks or months.

Plaster or stucco is a combination of water, aggregates, and a cementitious material.

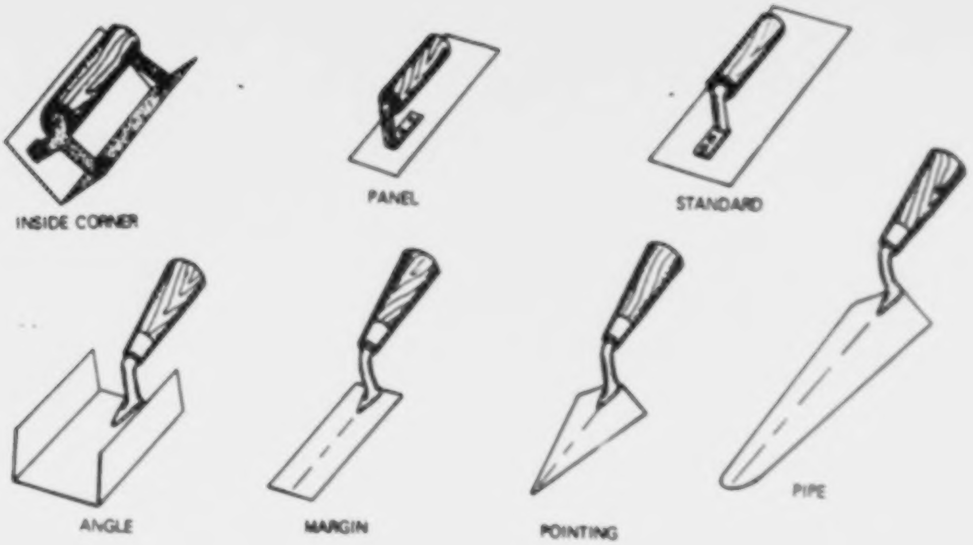
INSIDE CORNER
PANEL
STANDARD
ANGLE
MARGIN
POINTING
PIPE

Figure 17. Types of Trowels Used in Plastering

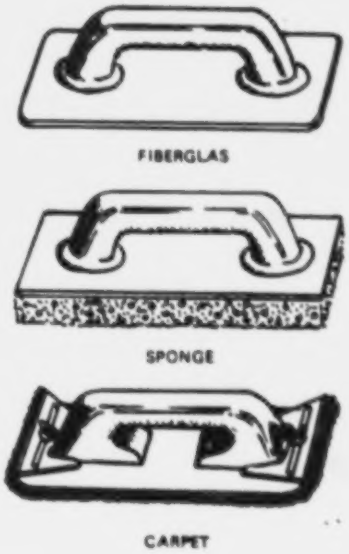
FIBERGLAS
SPONGE
CARPET

Figure 18. Types of Plaster Floats

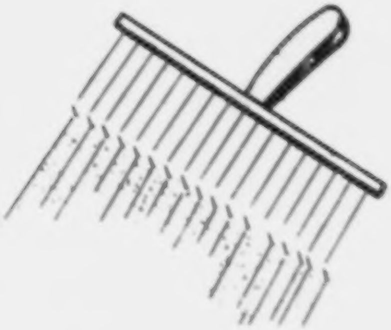

Figure 19. Scarifier

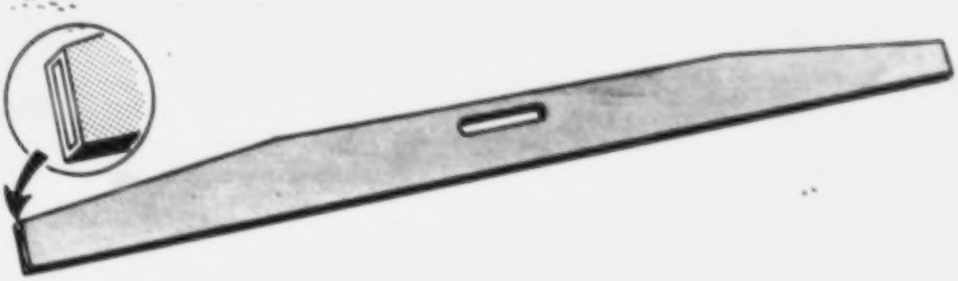

Figure 20. A type of Straightedge

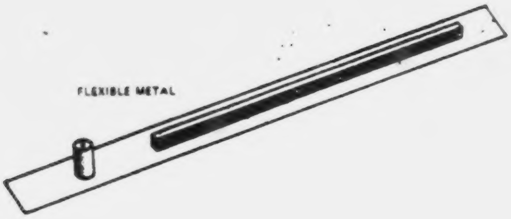

Figure 21. A Type of Darby

Water. Water is used in plaster to make the mixture workable and to dissolve the cementitious material so that it can act as an adhesive with the aggregate. Water must be clean and pure. The amount of water must be controlled, because too much water will result in a thin mixture and the plaster will not stick. If not enough water is used, the materials will not mix satisfactorily nor will it provide a workable mixture.

Aggregates. An aggregate is used in plaster mortar as a filler. It is mixed in proper proportions to overcome shrinkage. A good grade of aggregate is essential to obtain good plaster. Two kinds of aggregates are in broad usage today - sand and lightweight aggregates. Sand has the disadvantage of being heavy in weight. Lightweight aggregates overcome this excessive weight. Lightweight aggregates are a fairly new product in the plastering trade. Their popularity for use in a plaster mixture is due to the advantages that lightweight aggregates offer. Besides their obvious light weight, they are also fire-resistant.

Cementitious materials. The three main cementing agents used in plaster are gypsum, lime, and portland cement.

a. Gypsum. There are many kinds of gypsum. Gypsum is a product which should ordinarily be used indoors, because it absorbs or recombines with water readily. For exterior work, portland cement is recommended because of its weathering characteristics.

b. Lime. There are three broad classifications of lime. The first and best is finishing lime which is used to mix mortar for interior plastering. Next is mason's lime. It is used to improve the workability of mortar for laying brick, block, and stone. The third type is used for agricultural purposes.

c. Portland cement. Portland cement is a binder of cementitious material of unique strength and durability. It produces a hard and strong mortar, and is used by the plasterer as a dependable water resistant material. It is used extensively for exterior stucco work. It is excellent where dampness is present and where extreme hardness is required.

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There are other types of cementitious materials that can be used in plaster or stucco. Some of these are white portland cement and masonry cement.

Admixtures. A basic plaster mix consists of an aggregate, a cementitious material, and water. These materials are often supplemented by other ingredients to change the characteristics of the plaster mixture. Portland-cement mortars have poor workability and set slowly. Pure lime mortars are weak. Pure gypsum mortars have the characteristic of an irregular setting time. Therefore, materials (admixtures) are added to control or improve these characteristics. Admixtures are divided into four kinds - those that affect the setting time (accelerators and retarders), the strength, and the color.

a. Accelerators. Most plaster mixes do not need accelerators because they set fast enough. However, Portland-cement mortar sets slow enough to warrant use of an accelerator. One way to accelerate setting time is to heat the water and aggregate. Another way to accelerate setting time is by adding calcium chloride.

b. Retarders. Normally gypsum mortar will set too quickly for normal plastering. Retarders are normally added at the factory. There are various materials which can be added to retard setting time. However, they require much guesswork to obtain the proper proportions. The best way is to add a product that is sold under the label "retarder".

c. Strength. Fiber or hair is used in some mixes as an admixture to strengthen plaster. However, the necessity for their use has decreased with the use of gypsum. Gypsum produces a strong plaster. Portland cement is primarily used in exterior plastering or stucco. It is applied similarly to interior plaster. Sometimes added strength is desired and the use of hair or fiber can be used in the scratch coat.

d. Color. The addition of color to plaster is not a common practice because of the many drawbacks. Fingermarks and smudges are almost impossible to remove. It requires more time to complete a job and there cannot be any joinings. In other words, the work cannot be interrupted and started over again. The joining would show up as two shades of the same color.

Acoustic materials. When sound waves hit a wall or floor or ceiling, some of it is absorbed. The amount that is absorbed is referred to as its "acoustic ability". Glazed, hard surfaces do not absorb as much sound as a soft, absorbing material. If sound is allowed to "bounce off" a surface it is annoying to the human ear. However, if acoustic materials are used and the sound is absorbed, the sound will die quickly and be more compatible to the human ear.

Special plasters have been developed which improve the efficiency of sound absorption. They are called acoustic plasters.

PLASTER MIXES AND METHODS OF APPLICATION

Plaster or stucco mixtures are mixed in definite proportions of water, aggregate, and cementitious material. The hardness, quality, and durability of a plaster job depends upon the accuracy with which the ingredients are measured.

Too much water in the base coats will make plaster hard to apply. It will also make pockmarks in the plaster which will weaken the plaster. Too much sand in a plaster mixture can also weaken the plaster wall. A certain proportion of binder is needed to hold the aggregate together. When not enough binder exists in a mixture to "cement" the particles together, some of the particles tend to crumble off.

A plasterer calls a mixture "poor " when the mixture contains less binder materials than is normal. He likewise calls a mixture "rich" when the mortar contains a large proportion of binder materials.

Mortar for plaster can be mixed by hand or in a mechanical mixer. The mechanical mixer should be used whenever one is available because the mortar can be mixed more uniformly and it also reduces manpower required to do the job.

Plaster is normally applied in three coats. First you apply the scratch coat, then the brown coat, and finally, the finish coat. However, on some masonry walls, the two-coat system is used. The following instructions apply to the three-coat system. The only difference between it and the two-coat system is that the scratch coat is omitted.

There are three commonly used mixes for the base coat or scratch coat. Lime mortar, gypsum cement, both of which are used mostly as interior plasters; and the third Portland cement, which is used for both interior or exterior work.

Lime mortar. Lime plaster mortar is made by mixing lime and sand with sufficient water to make a plaster mixture. The amount of water varies with the dampness of the sand. Enough water must be added to the mortar to make it workable. Care must be taken, however, to prevent the mortar from being too fluid so that it will fall from the trowel when the plasterer tries to place it in position.

Quicklime or hydrated lime can be used to make lime mortar. Quicklime must first be mixed with water to form a putty to which sand is added. This is called "slaking". Hydrated lime can be added directly to the sand and water and then used immediately. If you use lime putty, it must be soaked ahead of time and allowed to set for several days to obtain plasticity and workability.

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The proportion of lime mortar ingredients will vary somewhat. The proportions depend upon the type and size of the sand and the plasticity of the lime. For average conditions, 2 to 1 is a good trail mix (2 cubic feet of sand to 1 cubic foot of lime putty).

When mixing lime mortar by hand, mix the dry lime and the dry sand together until the mixture is consistent throughout. Then add the water, and hoe the mixture until the desired workability is obtained.

When mixing lime mortar with a mixer, place water in the mixer first. Then add half of the sand and then all of the lime. Then add the remainder of the sand. Mix the mortar for from 1 to not more than 3 minutes. Then dump all of the mixture at one time.

Gypsum Cement. There are many types of gypsum based mortars which can be used for plaster work. They may be purchased with admixtures, such as a retarder or fiber. It also can be purchased with a retarder and no fiber content added. With such admixtures the rate of set can be controlled to suit the job for the scratch coat, being applied over metal lath, gypsum lath, or over surfaces with a poor suction ability. Use a mix of 2 parts aggregate to 1 part of gypsum. To mix the plaster in a mixer, add a measured quantity of water, approximately 50%, to the mixer first, then add half the sand; next the gypsum, and then the rest of the sand. Add the remaining water. Add all of the ingredients while the machine is in operation and let the machine run for 2 or 3 minutes.

Portland Cement. Portland Cement is used as an ingredient in mixtures for both interior and exterior (stucco) plaster work. When Portland Cement is used for interior work it is called Portland Cement plaster and for exterior work it is called Portland Cement stucco. Each coat of Portland Cement should be mixed using the same proportions regardless of the base, so that the rate of expansion and contraction is kept uniform.

The proportions for portland cement and for plaster and stucco are similar. A mix of 3-to-1 is recommended for stucco work. Three parts damp, loose aggregate to 1 part portland cement.

Machine mixing is the best method to use. When you charge (load) a machine, add the water first. Then add about 50 percent of the sand. Next, add cement and any other admixtures required. Last, add the rest of the water and the remainder of the sand. Mix until the batch is uniform in color and of the right consistency. Usually 3 to 4 minutes of mixing after all the ingredients are in the mixer is sufficient. Do not mix the ingredients too long. Overmixing will do more harm than good, because the plaster will tend to set up too fast.

The mixes are basically the same for the brown coat but with an increase in the proportion of aggregate.

Gypsum Cement. For the brown coat, mix the plaster using the ratio of 2½ parts aggregate to 1 part of gypsum. This mixture insures a good bond and a strong, hard mortar. For a brown coat over masonry surfaces of average suction ability, such as brick, clay tile, cement block, and cinder block, use a mix of 3 to 1.

Portland Cement. For the brown coat, mix the plaster the same as for the scratch coat, whether it be for plaster or stucco.

Finish Coat Mixtures. There are many types of finish coats in use, but the majority of plasterers use either a putty coat of a sand finish.

Putty Coat Finish. A putty coat finish is the most common type of finish used today. It can be worked to a smooth, straight, hard surface, and it is well suited to all types of surface treatments. One of its advantages is the ease of repair that it affords. For work of a general nature, mix gypsum cement with lime putty in the ratio of 3 to 1 (3 parts gypsum to 1 part lime putty). This mixture produces a good hard surface. If a harder surface is required, increase the amount of gypsum plaster. On the other hand, the use of too much gypsum plaster will make the mixture hard to spread. Admixtures can be used to accelerate or retard (slow down) the setting time. To mix a putty coat in a mixer add a measured quantity of water to the mixer, add the lime or lime putty and then add the gypsum. Let this mixture mix for 5 minutes. If a retarder or accelerator is to be used, place the required amount, after the first portion of gypsum is added to the mixer. The correct amount of retarder or accelerator is indicated on the container label. Read the instructions and follow them. Be sure that the retarder or accelerator is dissolved or it will burn spots through the finish coat. Once the mixture is well mixed discharge it from the mixer and let it stand at least one night.

For a mixture of good spreading quality and good floating ability, let it age for about a week.

Sand finish. Sand finish is one of the oldest forms of finishing materials used in the plastering industry. The mixture for sand finish is very similar to the mixture for regular lime mortar used as base coat material. The difference is that sand finish uses a very fine grade of sand. A light-colored or white sand is preferred.

The proportions for sand finish are 3-to-1 (3 parts of sand to 1 part of lime). Use a clean mortar box and a good screen. A 1/8" mesh wire cloth is about the right size for this work. Place a section of pipe (or roller) between the screen and mortar box as shown in Figure 22.

Pile the sand and lime, proportioned for the mix, at the side of the box. Turn it over once or twice with a shovel. Place a few shovelsful on the screen and roll the screen back and forth on the roller. This not only screens the material but helps to mix it as well.

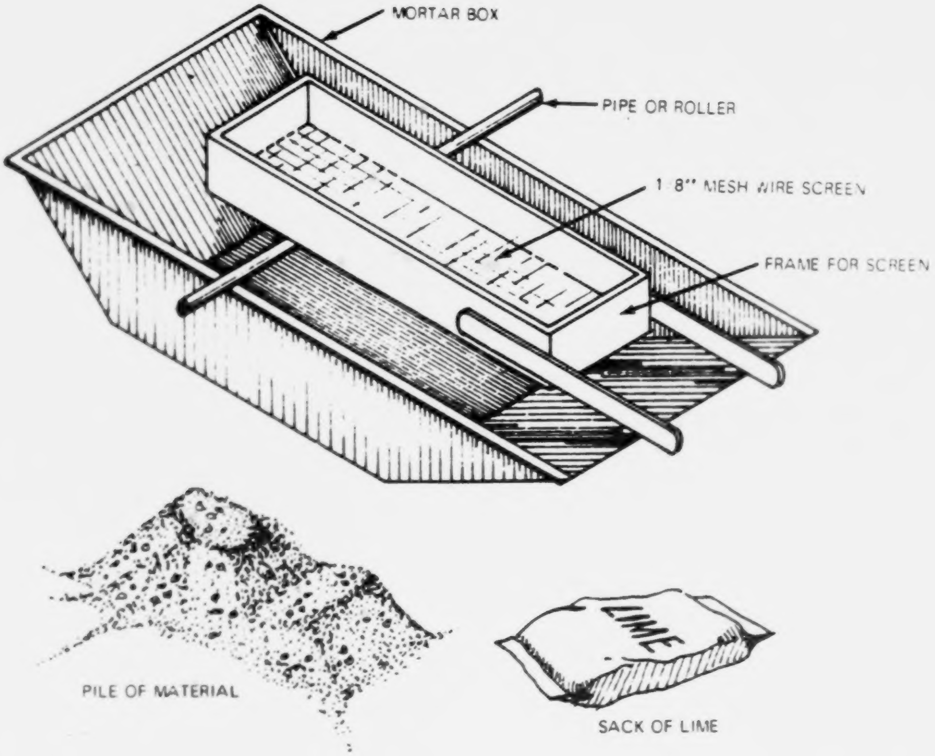


Figure 22. Mortar Box and Screen

Water should be put in the box before you start to screen. It will cut down on the dust. Hoe the mixture until it is well mixed. Let is stand for at least one night. For a mixture that has the good qualities to spread and float, let it age for about a week.

You can also mix this sand finish in a mixer. It will take much less time. The quality of the finish depends mostly on the screening of the sand. The float ability can be improved and the setting time can be lessened by mixing aged lime putty to the screened sand.

Stucco Mortar. The finish coat for stucco is much the same as the first two coats. It should have a ratio of 3-5 parts sand to 1 part Portland cement. Stucco usually is similar to a sand finish in that they both have a rough surface but stucco is sometimes patterened or textured. Stucco is mixed in a mixer following the same procedures as mentioned before.

Examining the consistency. The mixtures should be well mixed, uniform in color, avoid clumps of materials (hard cement or improperly combined cement and sand). Consistencies will vary from coat to coat and for the type of lath used. If the materials are uniform in color and of the right consistency, it is evident that a good blend has been achieved. If the mixture is a little stiff, add a small measured quantity of water to achieve the proper consistency. Mix additional batches using the same measured quantity of water.

Maintaining a good consistency during the plastering or stuccoing operation will give you good workability and adhesiveness.

Application of the plaster or stucco. As discussed before, most plasterers use the three-coat system to apply plaster. These three coats consist of the scratch coat, the brown coat, and the finish coat, as shown in Figure 23. They are applied in that order. Let's examine the mechanics of applying these three coats.

Scratch Coat. Before you apply the scratch coat, prepare the surface by attaching screeds and grounds as necessary. The thickness of the scratch coat should be between 3/8" and 5/8", but should not be less than 1/4" thick. The scratch coat serves a double duty, it stiffens the lath and provides a base for the brown coat.

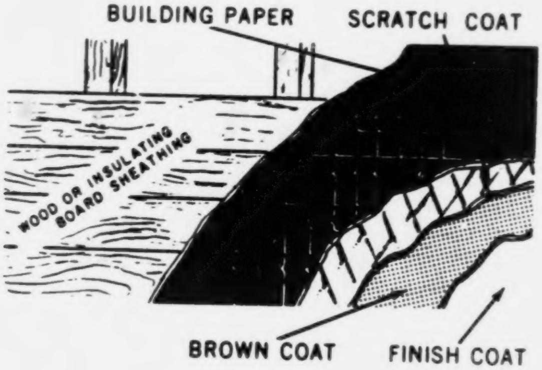


Figure 23. Three Coat Application

After the screeds are in place, push some plaster from the plaster board onto your hawk by using a trowel. Hold the hawk near the surface and push it off the hawk with a trowel, as shown in Figure 24.

Push enough of the plaster through the lath to insure complete adhesion, as shown in Figure 25. Apply a strip of plaster about 2 to 4 inches wide against one side of the screed. Level the strip of plaster with the wood screed. Remove the wood screed after the plaster screed is in place. You are now ready to apply the plaster, using the screeds as guides.

After you fill the space between the screeds with plaster, level the scratch coat with the straightedge and float the plaster into the low spots with the darby, as shown in Figure 26.

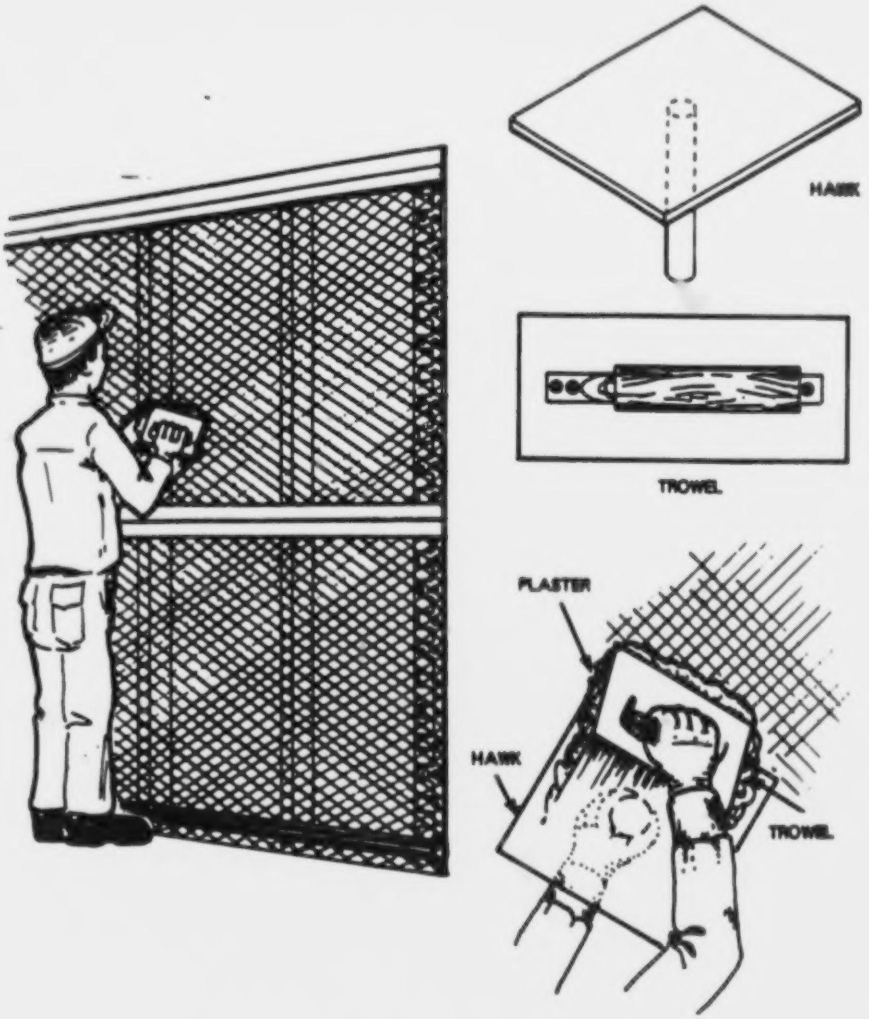

HAWK
TROWEL
PLASTER
HAWK
TROWEL

Figure 24. Placing Plaster on the Lath

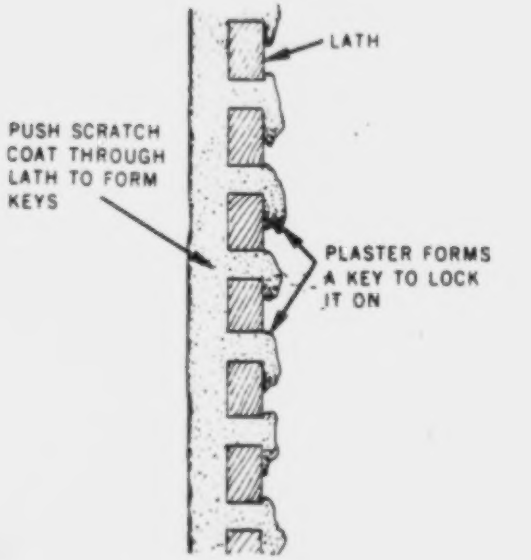

LATH
PUSH SCRATCH COAT THROUGH LATH TO FORM KEYS
PLASTER FORMS A KEY TO LOCK IT ON

Figure 25. Proper Keying of Scratch Coat

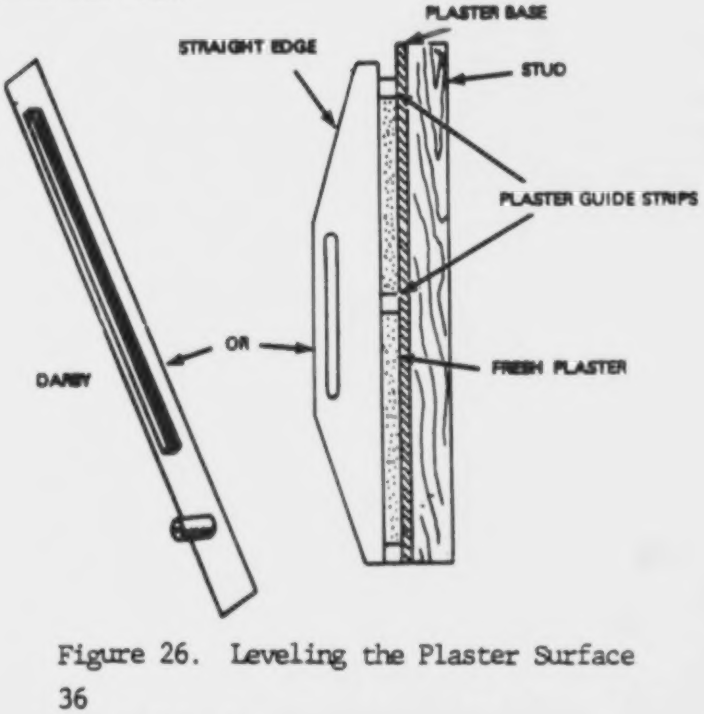

PLASTER BASE
STRAIGHT EDGE
STUD
PLASTER GUIDE STRIPS
OR
DARBY
FRESH PLASTER

Figure 26. Leveling the Plaster Surface

Before the scratch coat sets, scarify the surface. This will provide a bond for the brown coat.

After the scratch coat has set (usually 4 to 5 hours at a temperature of 70°) you can form 3/8-inch plaster screeds for the brown coat. As soon as the screeds will support a straightedge, you can start applying the brown coat.

Brown Coat. The brown coat consists of a layer of plaster not less than 3/8" thick. Apply the brown coat and scarify it in the same manner as the scratch coat. It is during the application of this coat that the leveling is done. Before the brown coat dries, form screeds for the next (finish) coat. If the brown coat is to have ceramic tile set on it, it is often called a neat coat. Also the neat coat is left smoooth and not roughened with a scarifier. More on the neat coat will be covered in the study guide on ceramic tile.

Finish coat. You can start to apply the finish coat as soon as the plaster screeds will support a straightedge. The application of the finish coat (putty coat in this case) is accomplished by following the seven steps outlined below.

Step 1. The first step is to apply the material to each side of each angle (corner). Use a featheredge to straighten (wipe out) the angles. Straight angles are important to the appearance of a finished plastering job. The featheredge is a tool similar to the straightedge. Figure 27 shows a featheredge. Apply putty coat mixture to the remainder of the wall so it will be about 1/8 inch thick.

Step 2. Place a second coat of putty coat over the first coat before it dries. Never apply putty coat over dried putty coat unless you scarify the surface. Place the second coat over the first as smoothly and evenly as possible with a trowel. It is usually more efficient to start at the left end of a wall and work toward your right.

Step 3. After the doubling-up coat, float the angles. This step consists of filling-in and squaring-up the angles (corners). Use an aluminum, plaster, fiberglass, or wooden float to work putty coat into a square, straight angle. Figure 28 shows the float held at a slight angle with the wall to keep the float from "digging in".

Step 4. After the angles have been floated, go over the surface once more. This consists of filling in blemishes or small depressions ("cat faces").

Step 5. After the "cat faces" are filled in, wet the entire surface with a large brush. Use the trowel at the same time that the wetting is done. Usually the brush is held in the left hand, and followed up with the trowel in the right hand. Use long strokes all the way across the room or area, holding the trowel at an angle to "polish" the surface.

Step 6. Go over the angles (corners) again. This can be done easily with a paddle, as shown in Figure 29. Note the sharpened end which is used to work into a corner.

Step 7. This step is a repeat of the water application (by brush) and troweling operation to remove any small imperfections.

If a texture is desired on the finish coat, it can be achieved by using a float or other device, such as a whisk broom, to obtain the finish desired.

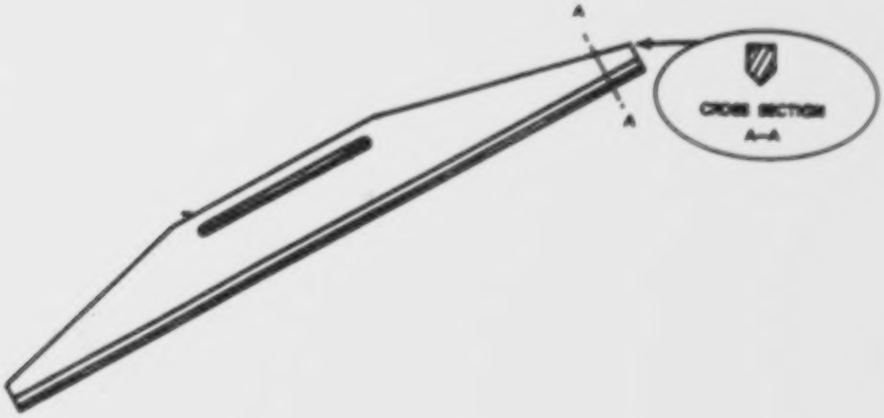
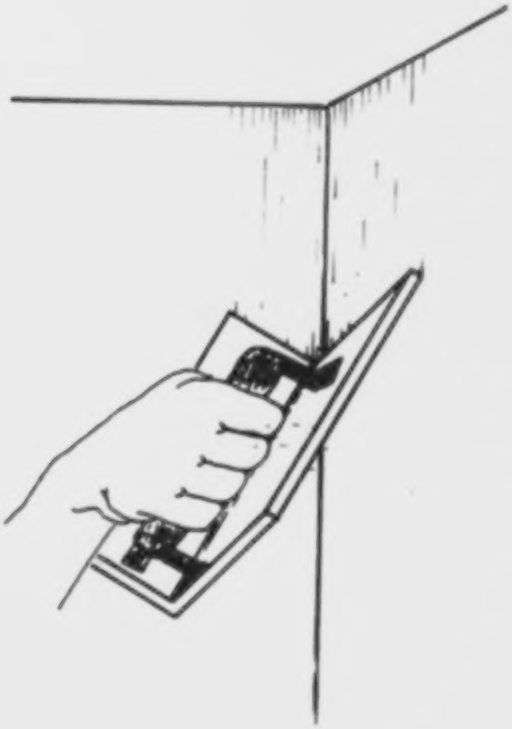


Figure 27. A Featheredge



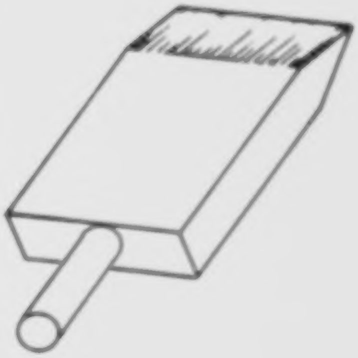


Figure 29. A Paddle

Figure 28. Floating the Corner

The procedures for the application of stucco are the same as with plaster but usually the scratch coat and brown coat are doubled up. In the double up work the stiffening of the lath and the leveling and plumbing of the walls is done. Again the finish coat is usually textured and is done by a float, or a whisk broom.

Curing Procedures. Portland Cement requires moist curing the same as Portland Cemend concrete. If Portland is used for all three coats as with stucco it must be moist cured for at least 2 days at a temperature above 50° F, and then allowed 5 days to dry. If the scratch and brown coats are Portland cement it must be moist cured for 2 days and be allowed to dry for 5 days before the next coat of plaster is applied. At the end of each curing period, before the next coat of plaster is applied, wet the surface evenly to prevent the hardened plaster from absorbing the moisture out of the fresh plaster. If the previous coat is not wet the plaster may flash set or become hard to work with. Most types of plaster cures (sets) enough in 4 or 5 hours to hold the next coat. After you have applied each coat of plaster, it must be cured or allowed to set up before continuing. After the finish coat is applied it must be kept moist for a period of 10 days to minimize any possible cracking. It is then allowed to dry or age for a period of 30 to 60 days before painting. Because the plaster must dry and small plaster cracks may occur during or after the first heating season, late fall, winter, and early spring, it is best to wait until after a heating season to paint.

Repair of Plastered Surfaces. Regardless of how careful or skillful you are in the preparation of mortar or application to a surface, cracks will occur. Sometimes this happens soon after the plaster is installed, and sometimes it doesn't happen until years later.

Before you repair any cracked or broken plastered surface, make sure the cause of the failure has been determined and the necessary repairs made to the structure so that the failure will not recur.

The cracks that appear in masonry surfaces are of several types. They consist of structural, map and shrinkage cracks, and sometimes even sections of loose or broken plaster. Cracks and breaks are caused by a number of things. Some cracks are caused by settling of a structure, moisture infiltration caused by water leaking through a structure, and excessive moist air inside the structure.

Although we can't prevent plastered surfaces from cracking, we can control the cracking by the use of control joints. We can divide large areas into rectangular sections by this means. In Figure 30 you can see a control joint in a concrete wall ready to receive stucco.

Walls and ceilings should be divided into rectangular panels, with control joints spaced a maximum of 20 feet apart. The metal used for control joints on exterior surfaces should be weatherproof and corrosion-resistant. When plaster or stucco is applied to metal reinforcement or directly to a masonry surface, control joints must be installed directly overall all existing joints in the wall.

Structural Cracks. Structural cracks are easy to identify since they are usually large carcks (1/4 inch or wider) extending either horizontally or vertically entirely through the plaster. The tools used to repair structural cracks consist of a putty knife, a pointing and finishing trowel, a sharp chisel, linoleum knife, a hammer, and a shallow mixing pan. Other tools may be used, depending on the width and position of the crack.

To repair a structural crack, first remove the loose material with a linoleum knife or chisel. Form the cracked surface into an inverted "V" shape so that the surface opening is narrower than the base, as shown in Figure 31. A crack shaped in this manner will help bond the new plaster to the old.

Chip out the old keyed plaster between the wood lath, so that a new key is formed when the patching material is forced into place. Brush all loose material out of the grooved area and if the base is made of wood, wet the wood lath and the edges of the grooved area to prevent suction of water from the fresh plaster.

When you repair a plaster surface which was placed on metal lath, widen the crack enough so that you can clean the mesh openings. Now when you force the patching plaster in the opening a good key is formed. After you have repaired the crack, you are ready to mix the plaster patching material.

Patching a structural crack should be done with two coats. The cracked area can be repaired with the same type material used in the original construction or by applying a first coat of 1 part cement (any type) and 2½ parts aggregate followed by a second coat consisting of 1 part lime and 1/2 part gypsum.

Press the first coat of patching plaster firmly into place, filling the groove almost to the surface of the original plaster. Allow the plaster to set until it is nearly dry, but not hard; then complete the patch by applying the finish coat. The last part of the patching operation is to strike the plaster off flush with the original surface and trowel it smooth. Make sure that a solid bond exists between the edges of the patch and the new plaster.

Map Cracks. Map cracks consist of several small lined cracks usually concentrated in a small area. This type of crack is usually caused by improper bonding between the plaster and the lath or improper curing of the plaster.

To repair map cracks, mix a quantity of gypsum plaster and water to a creamy consistency. Apply it to the cracked area with a paint brush. It may be necessary to paint the surface a second time after the first application has dried to completely seal all the cracks.

Shrinkage Cracks. Shrinkage cracks resemble map cracks in appearance, but are ordinarily confined to the finish coat. They do not extend entirely through the plastered surface. Shrinkage cracks usually result from careless workmanship, too rapid drying of the surface, insufficient troweling, troweling while the surface is too wet, or by troweling after the surface has become too dry.

Use the same materials and procedures to repair shrinkage cracks as you did to repair map cracks. Where shrinkage cracks penetrate through to the lath and will not retain a paint mixture, you should cut out the area and repair it in the same manner used with structural cracks.

Loose Plaster. Loose plaster is indicated by bulging and cracking of large areas of plaster surfaces. To determine the extent of loosened plaster, use a sounding rod or a blunt hammer and tap the surface lightly.

A dull sound will indicate the extent of the loose area. Loose plaster may result from excessive moisture caused by leaks in the roof, seepage through the exterior wall, or plumbing leaks in the structure. The excessive moitsure causes the plaster to become soft and destroys the bond of the plaster to the base. Remember, before you repair any damaged area, the source of moisture must be located and eliminated.

To repair this type of failure, you must remove all the loose plaster around the break until you locate solid plaster that is well-keyed to the lath. Also be sure that the lath is solidly secured to the structural frame of the building. If a lath is defective, remove it and replace it with a suitable lath. A masonry base must have at least 70% of the repair area roughened for bonding. Roughen it as you would have for the initial installation.

Repair these areas by replastering them with the same materials as used initially. One precaution to take for replastering on a wooden lath base is to dampen the lath and the adjoining plaster as was required to repair structural cracks.

Stucco. The repair procedures are the same as for plaster with one exception. Portland cement should be used for all the types of repair work done. Hydrated lime may be added at a rate of 25 lbs per sack of cement to aid in the workability of the Portland cement mix.

SUMMARY

Plaster is applied in three coats, each requiring a certain thickness, curing and preparation before the next coat is applied.

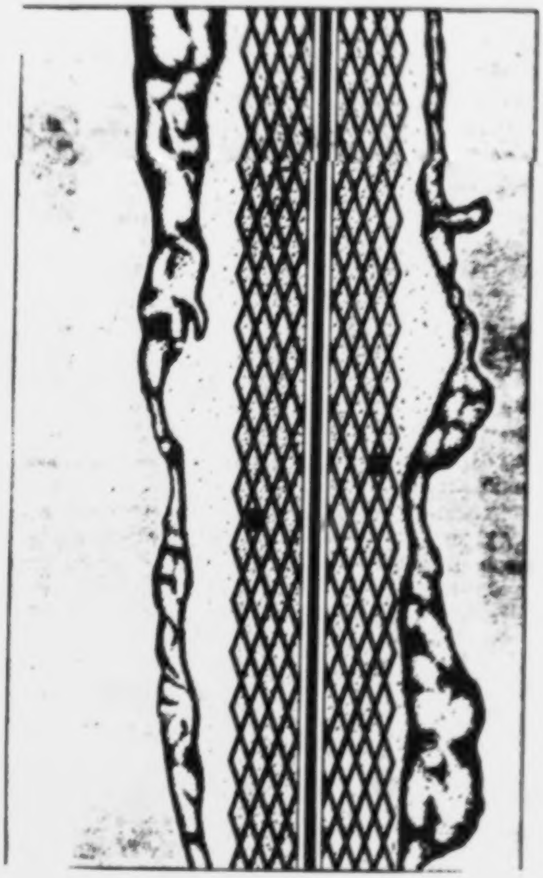


Figure 30. Control Joint

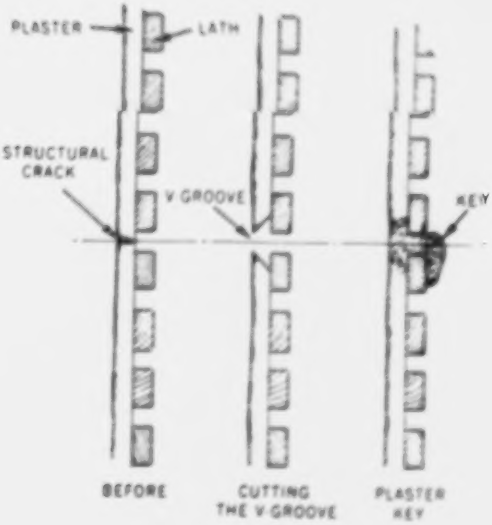


Figure 31. Repairing a Structural Crack

The plaster itself must be applied over a properly prepared base. The base consists of either wood, metal or gypsum board lath or properly prepared masonry surface.

While many of the tools you will use to apply plaster are the same ones as you use to apply and level concrete mortar, you will also need a hawk, scarifier, rods, darbies and screeds.

Plastering requires that sufficient plaster is applied to the scratch coat to insure a good key. The plaster itself must be properly mixed to create a good bond and finish. The scratch coat, as well as the brown coat, must be scarified and sufficiently cured before the next coat is applied. Sufficient plaster must be applied to provide a uniform coat of minimum thickness.

Plastering is the oldest art in the trades. New materials and techniques are constantly adding to the skills and creative abilities of the mason.

Plastering, a term applied to applying a cement-aggregate mix to an interior surface, is called stucco when applied to an external surface. Certain preparations must be made to the wall if plaster is to have a good base.

The aggregate and cement agent differ for inside and outside application. The different ingredients require different curing times.

Scratch, brown and finish coats are normally applied for a full plaster or stucco job.

The finish coat may take on any appearance the mason may desire, or have the time or skill to create.

Repairing cracks in plastered surfaces requires knowledge of the causes of cracks, as well as the skill in actually repairing the crack. Materials used to repair cracks should be the same as the original material. Old materials must be removed to the extent that a good repair job can be accomplished.

PUBLICATIONS

OBJECTIVE

Given AFR 0-2 and a list of publication numbers and titles, locate desired information in the numerical index, with instructor assistance for most parts of the task.

Given a commercial publication and a list of masonry tools and equipment, locate desired information in the commercial publication, with instructor assistance for most parts of the task.

Given an Air Force regulation, manual, and pamphlet, locate desired information in the publication, with instructor assistance for most parts of the task.

INTRODUCTION

A Master Publications library is authorized at base level by AFR 5-31. This library will include many types of publications by the base or higher authority. AFRs, AFMs and AFPs that are issued by higher authority and apply to the base will be included. AFR 5-1 establishes the various categories and type of Air Force publications and explains their use.

A base organization may, upon approval of higher authorities, have a publications file containing all the publications needed and used by it; however, due to the great expense connected with the AF publications systems, only a minimum number of functional libraries and individual sets are authorized.

During the time you are in the military it may call for you to look up and use Air Force publications and commercial publications. This portion of the study guide will cover this type of information.

INFORMATION

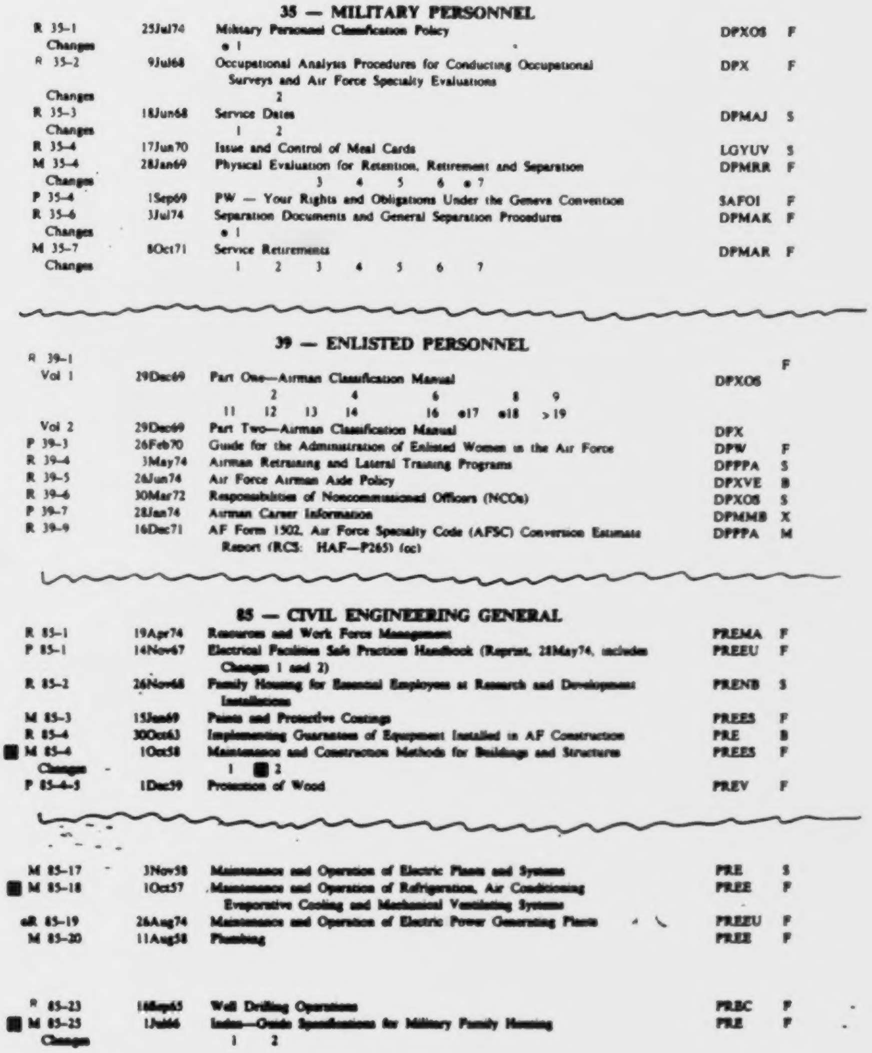
Assignment (Day 20). Read and study the material in this study guide and answer the questions.

AFR 0-2

AFR 0-2 is the Numberical Index of Standard and Recurring Air Force Publications. Note that the "0" in 0-2 denotes that the publication is an index. Figure 32 shows the way Air Force publications are listed in AFR 0-2 under series or category numbers. AFR 0-2 contains a numerical listing of published Air Force manuals, pamphlets, regulations, recurring periodicals and visual aids.

Some publication series numbers and subjects for AFRs, AFMs and AFPs are as follows:

- 1- Aerospace Basic Doctrine
- 5- Publications Management
- 9- Forms Management
- 10- Administrative Communications
- 11- Administrative Practices
- 34- Personnel Services
- 35- Military Personnel
- 50- Training
- 66- Equipment Maintenance
- 85- Civil Engineering - General
- 127- Safety
- 205- Security



35 — MILITARY PERSONNEL

R 35-1	25Jul74	Military Personnel Classification Policy	DPXOS	F
Changes		● 1		
R 35-2	9Jul68	Occupational Analysis Procedures for Conducting Occupational Surveys and Air Force Specialty Evaluations	DPX	F
Changes		2		
R 35-3	18Jun68	Service Dates	DPMAJ	S
Changes		1 2		
R 35-4	17Jun70	Issue and Control of Meal Cards	LGYUV	S
M 35-4	28Jan69	Physical Evaluation for Retention, Retirement and Separation	DPMRR	F
Changes		3 4 5 6 ● 7		
P 35-4	1Sep69	PW — Your Rights and Obligations Under the Geneva Convention	SAFOI	F
R 35-6	3Jul74	Separation Documents and General Separation Procedures	DPMAK	F
Changes		● 1		
M 35-7	8Oct71	Service Retirements	DPMAR	F
Changes		1 2 3 4 5 6 7		

39 — ENLISTED PERSONNEL

R 39-1				F
Vol 1	29Dec69	Part One—Airman Classification Manual	DPXOS	
		2 4 6 8 9 11 12 13 14 16 ●17 ●18 >19		
Vol 2	29Dec69	Part Two—Airman Classification Manual	DPX	
P 39-3	26Feb70	Guide for the Administration of Enlisted Women in the Air Force	DPW	F
R 39-4	3May74	Airman Retraining and Lateral Training Programs	DPPPA	S
R 39-5	26Jun74	Air Force Airman Aide Policy	DPXVE	B
R 39-6	30Mar72	Responsibilities of Noncommissioned Officers (NCOs)	DPXOS	S
P 39-7	28Jan74	Airman Career Information	DPMMB	X
R 39-9	16Dec71	AF Form 1502, Air Force Specialty Code (AFSC) Conversion Estimate Report (RCS: HAF—P265) (oc)	DPPPA	M

85 — CIVIL ENGINEERING GENERAL

R 85-1	19Apr74	Resources and Work Force Management	PREMA	F
P 85-1	14Nov67	Electrical Facilities Safe Practices Handbook (Reprint, 28May74, includes Changes 1 and 2)	PREEU	F
R 85-2	26Nov68	Family Housing for Essential Employees at Research and Development Installations	PRENB	S
M 85-3	15Jan69	Paints and Protective Coatings	PREES	F
R 85-4	30Oct63	Implementing Guarantees of Equipment Installed in AF Construction	PRE	B
■ M 85-4	1Oct58	Maintenance and Construction Methods for Buildings and Structures	PREES	F
Changes		1 ■ 2		
P 85-4-5	1Dec59	Protection of Wood	PREV	F

M 85-17	3Nov58	Maintenance and Operation of Electric Plants and Systems	PRE	S
■ M 85-18	1Oct57	Maintenance and Operation of Refrigeration, Air Conditioning Evaporative Cooling and Mechanical Ventilating Systems	PREE	F
●R 85-19	26Aug74	Maintenance and Operation of Electric Power Generating Plants	PREEU	F
M 85-20	11Aug58	Plumbing	PREE	F
R 85-23	16Sep65	Well Drilling Operations	PRBC	F
■ M 85-25	1Jul66	Index—Guide Specifications for Military Family Housing	PRE	F
Changes		1 2		

Figure 32. Example of AFR 0-2 Series and Category Numbers

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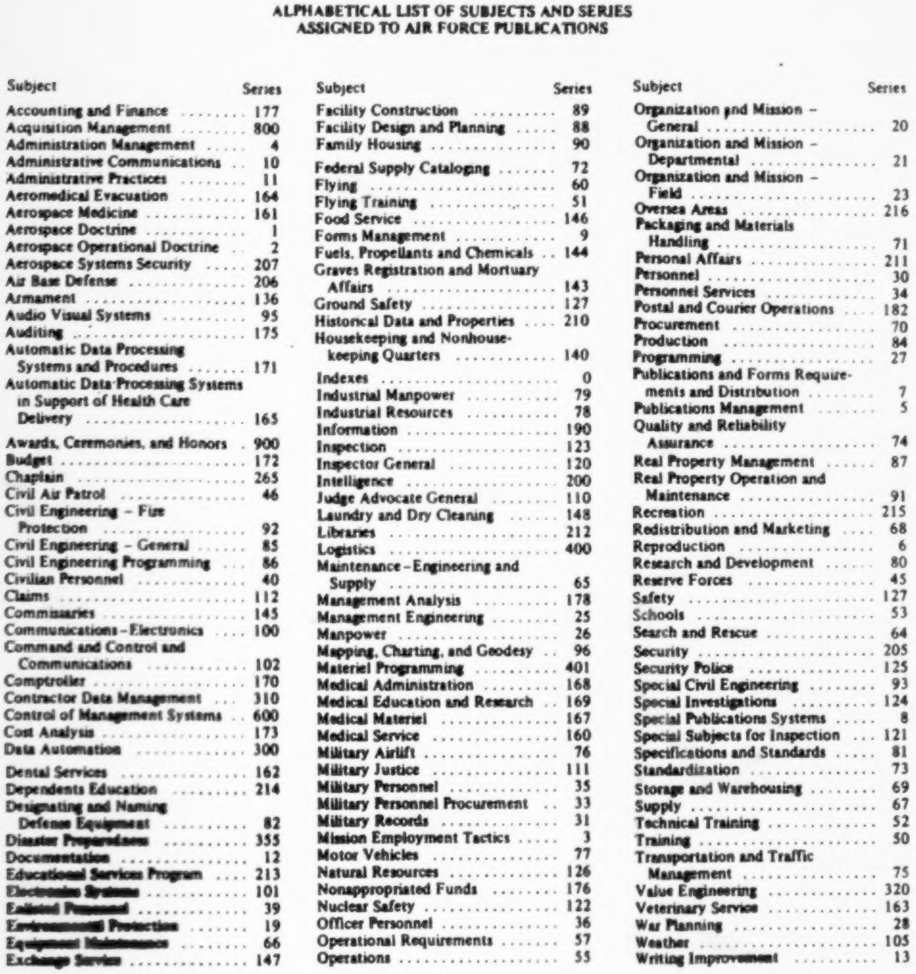
Air Force publications are listed numerically by series from Series 1, Aerospace Basic Doctrine, to Series 900, Awards, Ceremonies, and Honors. Within these listings are publications of interest to technical specialists. Some of these are: Series 127, Safety; Series 35, Military Personnel; Series 50, Training; Series 85, Civil Engineering - General; and many more. If you do not know the series number refer to the alphabetical list of subjects and series assigned to Air Force Publications within AFR 0-2. It is just an alphabetical index for AFR 0-2, as you can see by looking at Figure 33.



ALPHABETICAL LIST OF SUBJECTS AND SERIES
ASSIGNED TO AIR FORCE PUBLICATIONS

Subject	Series
Accounting and Finance	177
Acquisition Management	800
Administration Management	4
Administrative Communications	10
Administrative Practices	11
Aeromedical Evacuation	164
Aerospace Medicine	161
Aerospace Doctrine	1
Aerospace Operational Doctrine	2
Aerospace Systems Security	207
Air Base Defense	206
Armament	136
Audio Visual Systems	95
Auditing	175
Automatic Data Processing Systems and Procedures	171
Automatic Data Processing Systems in Support of Health Care Delivery	165
Awards, Ceremonies, and Honors	900
Budget	172
Chaplain	265
Civil Air Patrol	46
Civil Engineering – Fire Protection	92
Civil Engineering – General	85
Civil Engineering Programming	86
Civilian Personnel	40
Claims	112
Commissaries	145
Communications – Electronics	100
Command and Control and Communications	102
Comptroller	170
Contractor Data Management	310
Control of Management Systems	600
Cost Analysis	173
Data Automation	300
Dental Services	162
Dependents Education	214
Designating and Naming Defense Equipment	82
Disaster Preparedness	355
Documentation	12
Educational Services Program	213
Electronics Systems	101
Enlisted Personnel	39
Environmental Protection	19
Equipment Maintenance	66
Exchange Service	147
Facility Construction	89
Facility Design and Planning	88
Family Housing	90
Federal Supply Cataloging	72
Flying	60
Flying Training	51
Food Service	146
Forms Management	9
Fuels, Propellants and Chemicals	144
Graves Registration and Mortuary Affairs	143
Ground Safety	127
Historical Data and Properties	210
Housekeeping and Nonhousekeeping Quarters	140
Indexes	0
Industrial Manpower	79
Industrial Resources	78
Information	190
Inspection	123
Inspector General	120
Intelligence	200
Judge Advocate General	110
Laundry and Dry Cleaning	148
Libraries	212
Logistics	400
Maintenance – Engineering and Supply	65
Management Analysis	178
Management Engineering	25
Manpower	26
Mapping, Charting, and Geodesy	96
Materiel Programming	401
Medical Administration	168
Medical Education and Research	169
Medical Materiel	167
Medical Service	160
Military Airlift	76
Military Justice	111
Military Personnel	35
Military Personnel Procurement	33
Military Records	31
Mission Employment Tactics	3
Motor Vehicles	77
Natural Resources	126
Nonappropriated Funds	176
Nuclear Safety	122
Officer Personnel	36
Operational Requirements	57
Operations	55
Organization and Mission – General	20
Organization and Mission – Departmental	21
Organization and Mission – Field	23
Oversea Areas	216
Packaging and Materials Handling	71
Personal Affairs	211
Personnel	30
Personnel Services	34
Postal and Courier Operations	182
Procurement	70
Production	84
Programming	27
Publications and Forms Requirements and Distribution	7
Publications Management	5
Quality and Reliability Assurance	74
Real Property Management	87
Real Property Operation and Maintenance	91
Recreation	215
Redistribution and Marketing	68
Reproduction	6
Research and Development	80
Reserve Forces	45
Safety	127
Schools	53
Search and Rescue	64
Security	205
Security Police	125
Special Civil Engineering	93
Special Investigations	124
Special Publications Systems	8
Special Subjects for Inspection	121
Specifications and Standards	81
Standardization	73
Storage and Warehousing	69
Supply	67
Technical Training	52
Training	50
Transportation and Traffic Management	75
Value Engineering	320
Veterinary Service	163
War Planning	28
Weather	105
Writing Improvement	13

Figure 33. Example of Alphabetical List of Subjects from AFR 0-2

Air Force publications are filed numerically just as they are listed in AFR 0-2.

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COMMERCIAL PUBLICATIONS

The masonry shop in which you will work will probably have a file of booklets, manuals and pamphlets that have been provided by the manufacturer of the equipment in the shop. These publications will provide information on the operation and maintenance of each piece of equipment. You should never attempt to operate a power tool with which you are not familiar nor should you make any repairs without first reading the manufacturer's manual for that tool.

Commercial publications may also include catalogs from which tools, parts for equipment and supplies may be ordered. It is important, when ordering from a catalog or manufacturer's parts list, to insure that you have the correct stock number or part number. It is also important in order to save time when looking for specific information to first look in the general index.

AIR FORCE REGULATIONS

Air Force Regulations announce policies, assign responsibilities, direct actions, and when necessary, prescribe brief procedural details. Regulations are permanent directives and apply to all Air Force military and civilian personnel.

Examples of a few AFR's pertaining to you in the Air Force are:

AFR 35-10	Dress and Personal Appearance of Air Force Personnel
AFR 39-1	Airman Classification Regulation
AFR 85-1	Resources and Work Force Management

AIR FORCE MANUALS

An Air Force Manual may be general in content and deal with principles of doctrine. it may be a compilation of material related to an entire function. or it may be a step-by-step directive on the accomplishment of an operation. Air Force Manuals are also indexed in AFR 0-2.

Manuals are also issued to support specific training requirements and to disseminate study and reference materials.

Examples of a few AFMs pertinent to technical fields are as follows:

AFM 50-25	Small Arms Ranges
AFM 67-1	USAF Supply Manual
AFM 85-3	Paints and Protective Coatings
AFM 85-42	Carpentry Handbook
AFM 126-2	Natural Resources - Land Management

There are many manuals, called Field Publications, written and published at a Major Air Force Command level or lower that are not mentioned in this text. These manuals pertain only to a specific Air Force command and cannot be satisfactorily taught in a course of this type. Upon being assigned to a major command (SAC, TAC, MAC, etc.), you should become familiar with the command publications applicable to your job.

AIR FORCE PAMPHLETS

Pamphlets usually contain information rather than directive material. They are usually issued as a brochure or booklet and may be written in an informal style. They are permanent in nature, but when practicable, an expiration clause may be included.

Examples of a few AFPs pertaining to technical fields are as follows:

AFP 18-4	Project Save Energy
AFP 85-1	Electrical Facilities Safe Practices Handbook
AFP 88-26	Construction of Secure Conference Rooms (FOUO)
AFP 88-41	Interior Design

There are other indexes and publications (many others) in addition to those outlined above; however, the above are the ones most useful to you. Visit your maintenance administrative section and become familiar with the publications listed. You will find that personnel in the adminstrative career field have a good knowledge of the various publications systems and will always be able to assist you in locating and obtaining the publications needed.

SUMMARY

Air Force Regulations announce policies, assign responsibilities, and direct actions.

Air Force Manuals contain permanent and detailed instructions, procedures, and techniques that enable personnel to perform their duties.

Air Force Pamphlets usually contain informative, rather than directive material. However, some are directive, as in the case of AFP 85-1.

Air Force Manuals, Pamphlets and Regulations are indexed in AFR 0-2 along with Recurring Periodicals and Visual Aids.

Equipment manufacturers publication should be referred to prior to attempting to operate or repair equipment you will have in your organizational activity. These same publications will also be useful in ordering parts and supplies and may be the only published source of information available.

To be of maximum value to your organization and the Air Force, you should make a great effort to keep current on new publications and changes to publications pertaining to you and your organization. You should especially review new indexes frequently for the purpose of identifying new publications which will assist you in your work.

QUESTIONS

1. Which numerical index lists Air Force Manuals and Pamphlets?
2. What type information is contained in Air Force Manuals?
3. What type information is normally contained in Air Force Pamphlets?
4. Which section of your organization will assist you in obtaining the publications you require?
5. What type publications are indexed in AFR 0-2?

REFERENCES

AFR 0-2, Numerical Index of Standard and Recurring Air Force Publications

INSTALLING WALL AND FLOOR TILE

OBJECTIVE

Given specifications and the tools and equipment for tile work, and observing safety precautions, cut, drill and shape ceramic tile, with instructor assistance for most parts of the task.

Working as a member of a team, layout an area for tile and determine the number of tiles required. The completed area must be ready for the application and the quantity of tile determined. Instructor assistance may be provided for most parts of the task.

Given wall tile, adhesive and a prepared area, apply the adhesive and tile to a specified area. The tile must be installed plumb and level, adhere to the surface, and present a pleasing appearance. Instructor assistance may be provided for most parts of the task.

Given floor tile, adhesive, and a prepared area, apply the adhesive and floor tile to a specified area. The tile must be leveled and spaced, adhere to the surface, and present a pleasing appearance. Instructor assistance may be provided for most parts of the task.

Given tools and materials, grout tile joints to specified depth and clean excess grout from the surface. Finished work must present a pleasing appearance and the joints filled to the specified depth and excess grout removed. Instructor assistance may be provided for most parts of the task.

INTRODUCTION

From ancient times man has used thin baked clay shapes (tile) to cover other structures. Specimens of tile made in 6000 B.C. exist in museums of the world. Originally, the word "tile", as related to building construction, referred to the baked clay tiles used to cover floors, roofs, walls and other structures.

Today there are several types of building material used to cover various parts of structures and referred to as tile. In most cases, tile made from products other than clay are identified by placing the type of material before the word "tile". Some of these are aluminum, plastic, asphalt and acoustic tile.

INFORMATION

Assignment (Days 20, 21, 22, 23) read and study the material in this study guide.

Ceramic Tile

As a masonry apprentice, you will be working with masonry specialists installing and repairing ceramic and quarry tile surfaces. Any tile made of clay and baked in kilns is called ceramic tile. In this study guide we will discuss types, classification shapes and sizes, and methods of setting tile. The procedures for preparing wall and floor surfaces to be tiled, setting wall and floor tile, cutting tile, and the care of tools and equipment will also be discussed. Installation of both wall and floor tile will also be covered, along with grouting of the tile.

Before you learn how to set ceramic tile, you need to know the types of tile, shapes and sizes of tile, and classes of tile which are available for different uses.

Among the characteristics you must consider when selecting tile for a job are the types, the classes and the shapes and sizes of tile.

Types of Tile. Tile are made of clay and dried in a kiln. There are many types of tile available on the market today, but the types that you will be concerned with most are glazed tile, quarry tile, and mosiac tile.

Glazed Interior Tile. Nonvitreous tile are normally 4¼ by 4¼ inches or 6 by 6 inches square. They are used on walls and floors. Aluminum oxide powder is added to glazed floor tile to form a nonslip surface.

Glazed Exterior Tile. This tile is weatherproof and similar to glazed interior tile in appearance. The main difference is that this tile has a semivitreous or vitreous body which enables it to withstand severe freezing. It is used for covering fronts of buildings, swimming pools, etc. It is available in the same sizes and shapes as glazed interior tile and can be obtained in a variety of colors.

Quarry Tile. This type of tile is unglazed and made of a cheaper grade of clay. It is normally in earth colors of orange, red, or brown. Quarry tile is made by the process in which the clay mixture is extruded and the tile is cut to length by means of a wire. The tiles are then fired in a kiln (oven). Quarry tile is usually 1/2 to 1 inch thick and underscored on the bottom. They are laid with the smooth side up and are ideal for use on floors in kitchens, entranceways, etc., where traffic is heavy. They resist the absorption of moisture.

Mosaic Tile. A vitreous tile that is popular for use on floors, bathrooms, shower rooms, countertops, table tops, etc., is ceramic mosaic. These tile are small, multicolored squares, rectangles, and other shapes pasted in position on sheets of paper to form a pattern. Mosaic tile are set using the same procedures as ceramic tile.

Classes of Tile. The ceramic tile industry has adopted a classification for ceramic tile based on the percentage of water the tile will absorb. On this basis, there are four classes of tile:

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(1) Nonvitreous - A tile that will absorb more than 7 percent of its weight in moisture.

(2) Semivitreous - A tile that will absorb more than 3 percent, but less than 7 percent, of its weight in moisture.

(3) Vitreous - A tile that will absorb less than 3 percent of its weight in moisture.

(4) Impervious - A tile that will resist the absorption of moisture.

The semivitreous and nonvitreous tiles must be soaked in water before they are laid to prevent them from absorbing water from the mortar.

Shapes and Sizes of Tile. There are many sizes of ceramic tile manufactured today; and, there are many shapes of each size. The most common size is the 4¼ - by 4¼-inch ceramic tile. Some of the shapes of the 4¼- by 4¼-inch ceramic tile are shown in Figure 34. Different manufacturers make various shapes to meet their own requirements. Corner tile are made in a right and left pattern for use in opposite corners. Consequently, they are designated "R" and "L" for right and left.

There are also various shapes of trim tile. Figure 35 shows some of the more common shapes of trim tile. But here again, each manufacturer makes many different shapes for various uses. Notice in Figure 35 the cap or curb tile. These can be fitted very easily around a lavatory or kitchen sink. Figure 36 shows how some of these various tiles are used in a bathroom installation. Study this figure and you can see how various shapes are used.

Some types of ceramic wall tile have lugs that stick out 1/32 of an inch to aid in keeping the proper grout joint of 1/16 of an inch. The lugs are not figured into the size of the tile. If it was figured into the size the common size would increase by 1/16 of an inch.

Setting tile used to be a job for a professional workman. But today, new materials, adhesives, tools, and practices have made it easy for a person with a little practice to make a professional-looking job. Basically, there are two methods of setting tile. One method uses an adhesive to hold the tile to a surface. In the other method, the tile are set into a plaster base.

Most tile today are set using the adhesive method;however, the plaster base is still used where tile will be subjected to water in such areas as on floors and around kitchen sinks. We will cover both methods, but let's look at some of the practices which will be used, regardless of the type of installation.

Again, setting ceramic tile is not difficult nor does it require a lot of experience to do a professional looking job if you learn a few basic practices. Some of the practices that you must learn are how to cut and fit a tile, how to cut around a pipe or other fixture, and how to join tile at a corner.

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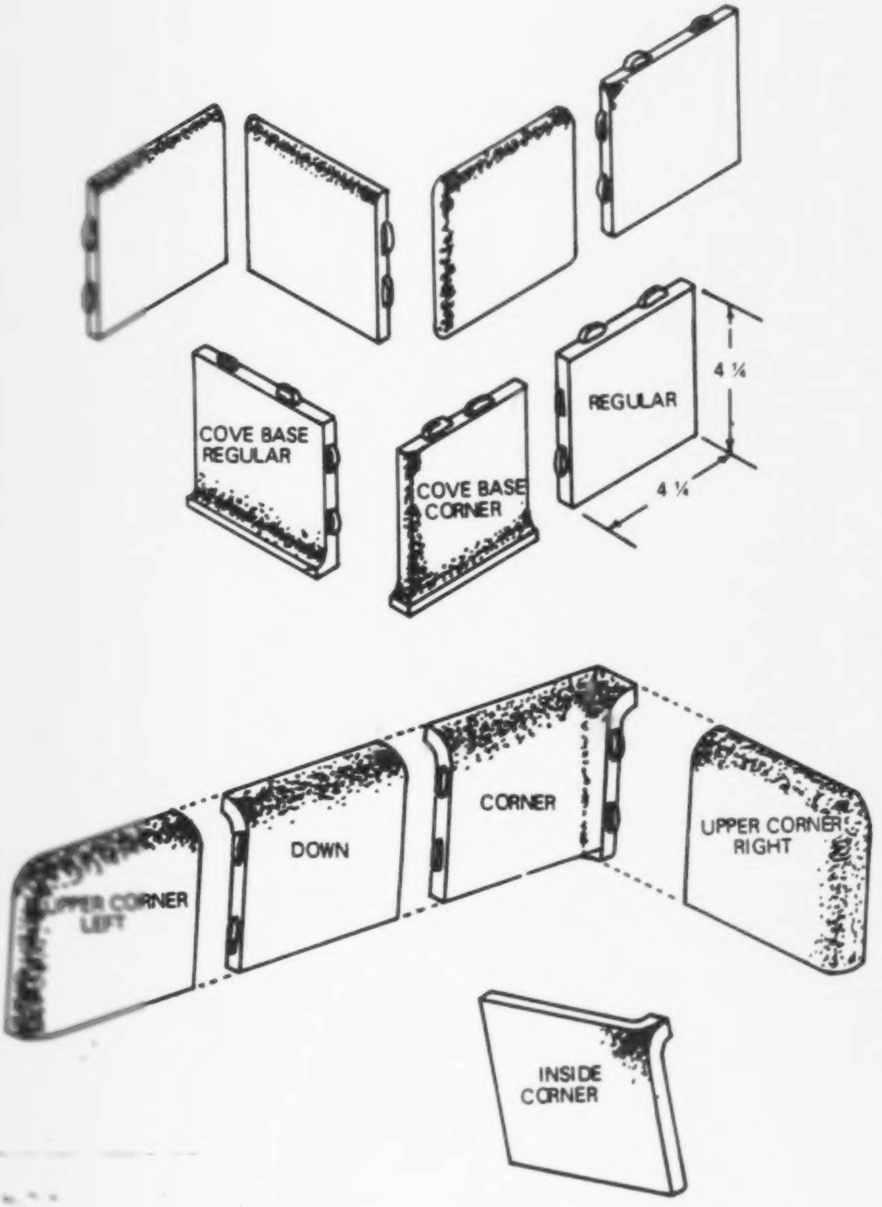
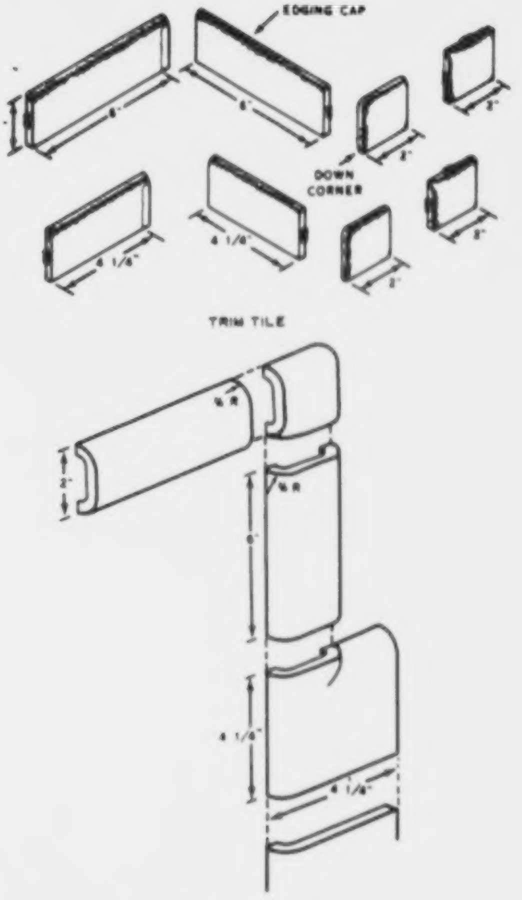

4 ¼
REGULAR
COVE BASE
REGULAR
COVE BASE
CORNER
4 ¼
CORNER
DOWN
UPPER CORNER
RIGHT
UPPER CORNER
LEFT
INSIDE
CORNER

Figure 34. Shapes of 4¼" X 4¼" Tile



TRIM TILE

CAP OR CURB TILE

Figure 35. Shapes and Sizes of Trim Tile

Cutting and Fitting Tile. Seldom are walls laid out where the tiles can be set without cutting them. This cutting normally requires a straight cut which can be done in several different ways. One method, and it is the best method to use when a smooth cut is desired, is using a tile saw. If there is no power available use a tile cutting machine (tile cutter) to cut the tile. In the event that a tile saw or tile cutter are not available, in an emergency, the tile can also be cut with a glass cutter. You can smooth the cut edge of a tile cut with a tile cutter or glass cutter with a carborundum stone.

Holes, notches for pipes, or other irregular cuts are made using a variety of tools. When a hole is to be cut in a desired location on a tile a hole breaker should be used. A tile hammer is used with the hole breaker to punch the holes, as the hole breaker simply holds the tile as shown in Figure 37. A tile hammer can also be used to remove tile from a wall or floor.

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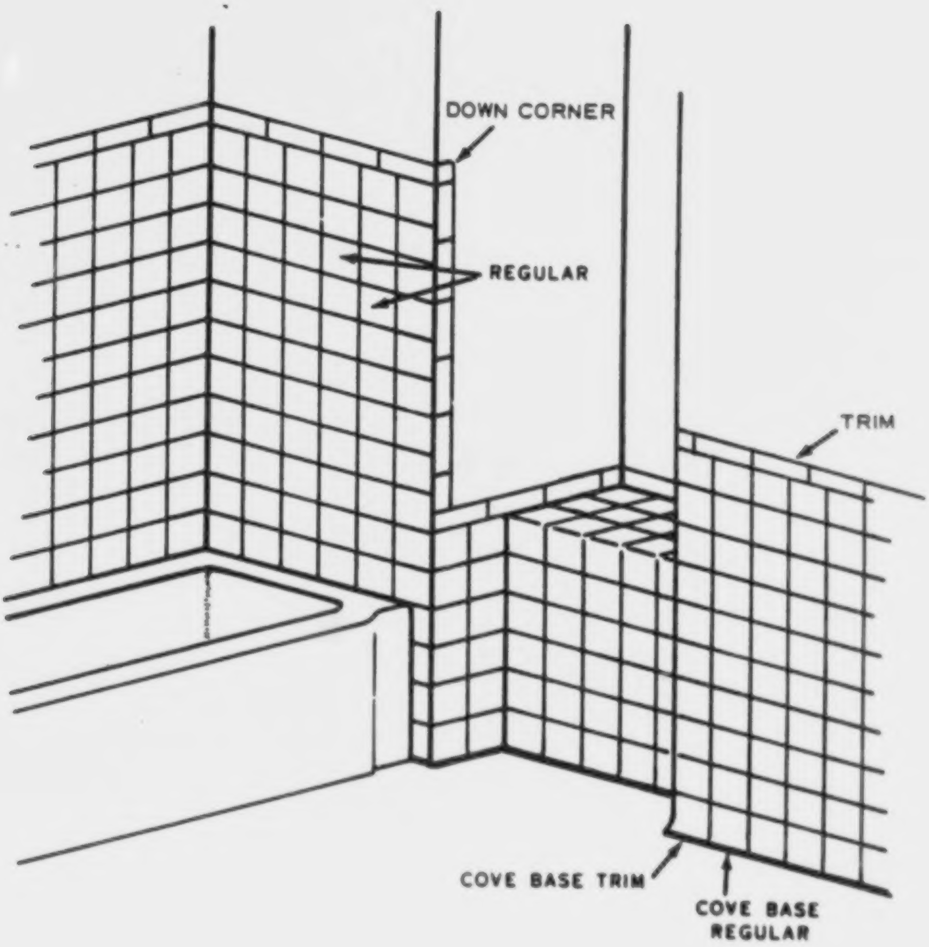

Figure 36. Typical Places of Use for Wall Tile

When you use a tile saw follow the same safety procedures that are taken when using the masonry saw, i.e., use a grounded plug (three prong plug), before changing a blade unplug it from the power source. Mark the tile with a grease pencil (water will wash away a pencil mark), and place it on the cutting table aligning the mark in the middle of the channel for the blade. Turn on the saw and pump and allow the water to pass over the blade before slowly pushing the cutting table into the tile blade. Once the cutting is completed turn off the equipment and clean the equipment as necessary. If using a tile cutter mark the tile with a pencil where you want it cut and place it in the machine as shown in Figure 38. After fastening in the machine, score the tile as shown in Figure 39.

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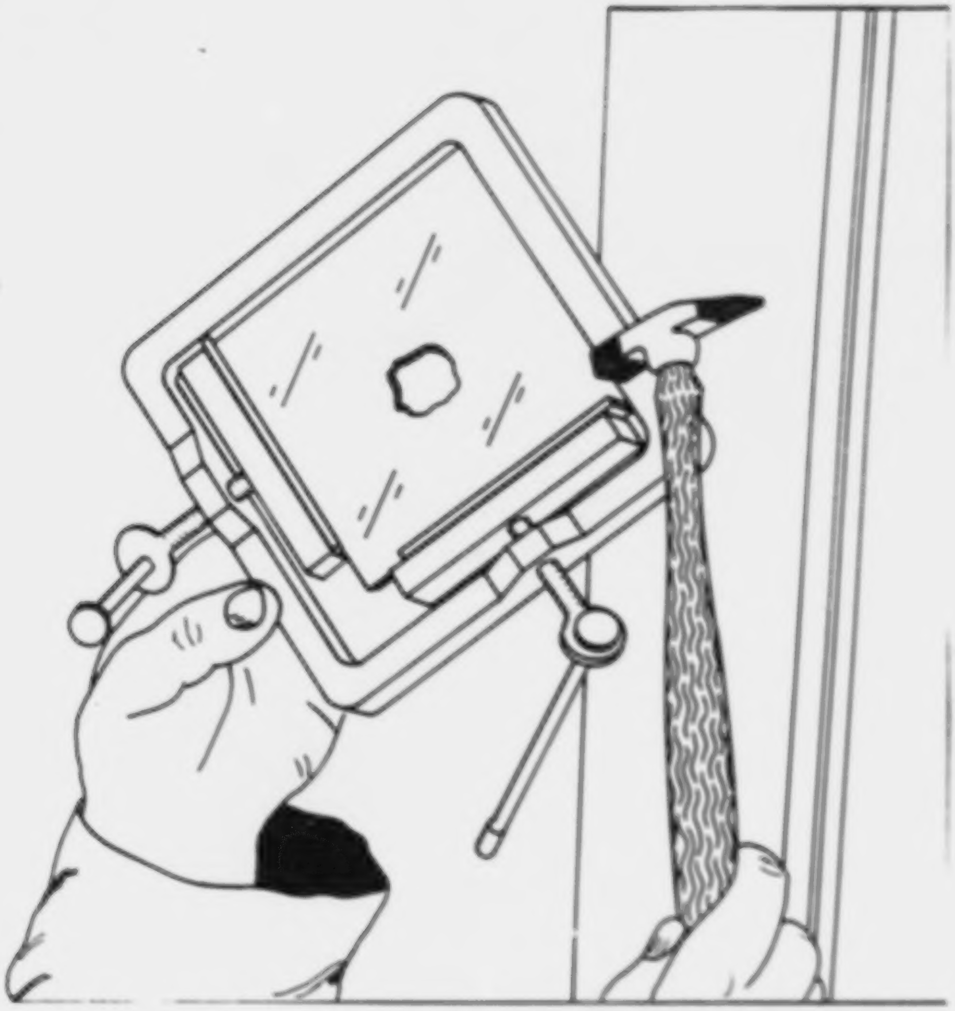

Figure 37. Making a Hole with a Hole Breaker and Tile Hammer

After you score the tile, break it by pressing down on the handle of the tile machine, as shown in Figure 40. If you don't cut close enough to the line or leave a rough edge on the tile you can smooth the cut with a carborundum stone or electric grinding wheel. Wear goggles or a face shield when using the grinding wheel, as tile chips easily. Notches for pipes or other irregular cuts can also be made by marking the area with a pencil. Use tile nippers to nibble away small bits of tile inside the scored lines. Do not take large bites or the tile will break in the wrong place. A cut tile and a pair of tile nippers are shown in Figure 41.

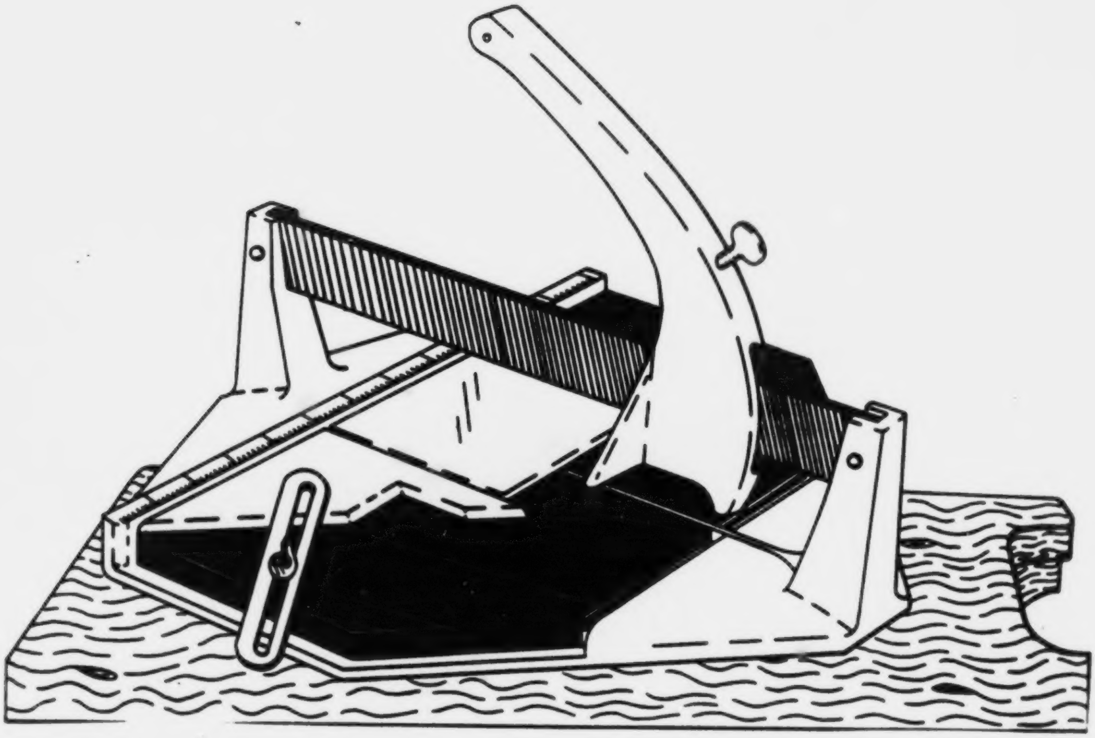

Figure 38. Placing a Tile on the Tile Cutter

Preparation and Layout for Wall Tile. The most important step in the setting of wall tile is in the preparation of the surface. Very little preparation needs to be done to new construction. In new construction the walls are generally now made from gypsum board and in some cases are still plaster. With new construction the walls usually have no fixtures installed to make application of the tile simpler. In some cases, remove those fixtures that are not to be tiled around to make a smooth level surface. The walls to be tiled should also be primed, to seal the surface, before the application of the adhesive. If you are to tile an existing wall remove the shoe molding, baseboard and all fixtures that you are not going to tile around. Also, remove the towel bars, shower curtain rod, soap and toilet tissue receptacles, and switch and outlet plates. Place a cloth over drains, especially the drain in the tub. Remove the handles and escutcheon plates from faucets. Wrap the threads with masking tape for protection. Check the walls for loose plaster and paint. If walls have been painted with calcimine, or other paints that are not well-bonded, wash the wall with trisodium phosphate or another suitable detergent and rinse thoroughly. Fill all holes and cracks with patching plaster and when thoroughly dry, sand the surface smooth.

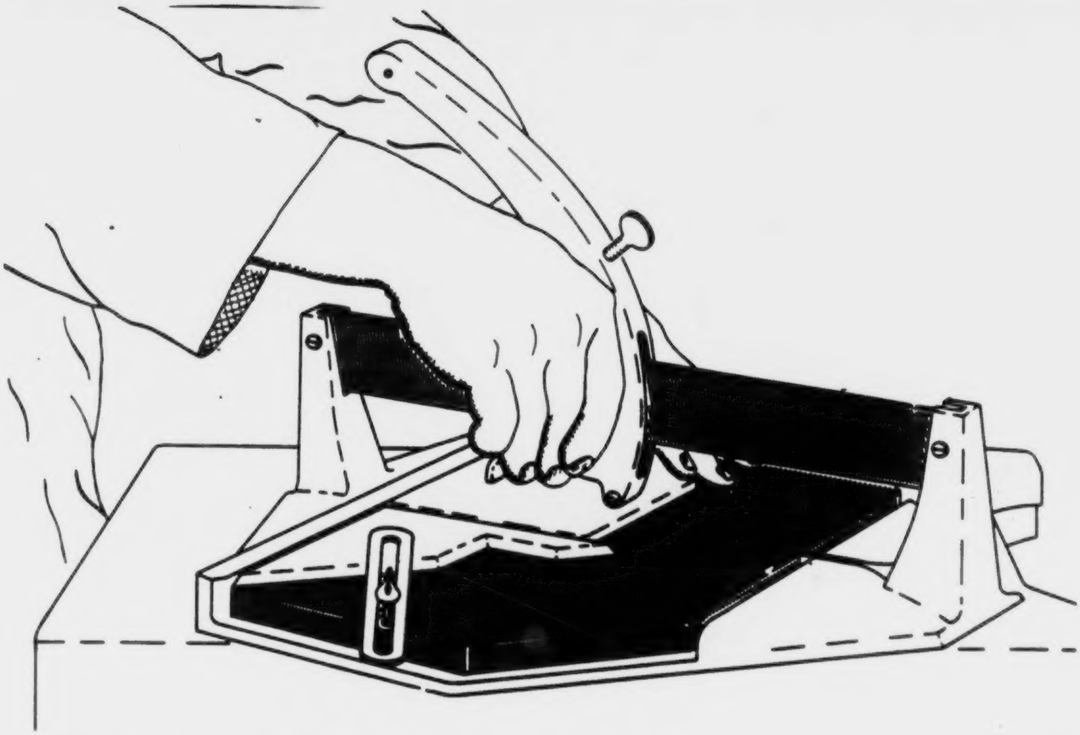

Figure 39. Scoring the Tile on a Tile Cutter

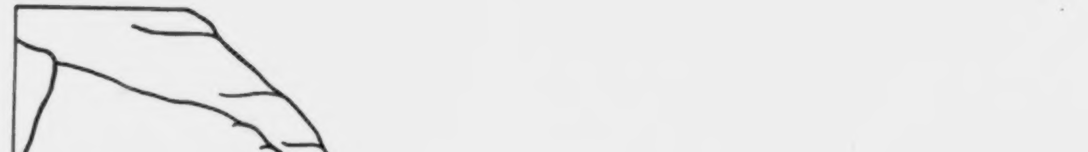

Figure 40. Breaking the Tile on a Tile Cutter

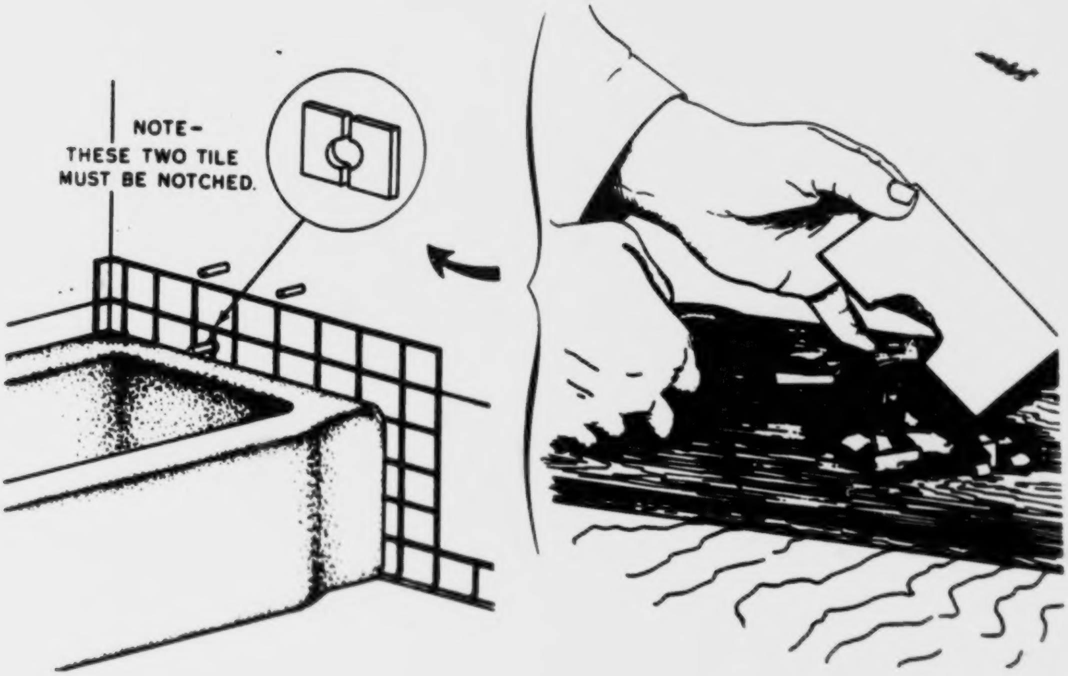

Figure 41. Cutting a Tile to Fit Around a Pipe with Tile Nippers

If the wall is very rough, out of plumb, or the plastering is badly cracked, cover it with ½-inch gypsum wallboard. Waterproof plywood, 3/8-inch thick, can also be used. Do not use soft fiberboards or soft materials to level the surface. Calk all joints around pipes and fixtures. Prime the walls with two coats of a good quality wall primer. Brush or roll the first coat on vertically. When it is dry, brush or roll the second coat on horizontally. Make certain all joints, cracks, and corners are sealed. If primer is not available, use a good quality of shellac.

Laying Out the Job. After you have prepared the surface and you have selected the tile, the next step is to layout the job. The success of your job depends largely on your ability to keep the tile level and plumb. In deciding where to start remember the wall should be tiled first. In order to keep the rows of tile straight and level, it is necessary to make certain that the first row (cove base row) is level.

Before you set the cove base row of tile you must check the floor for levelness with a mason's level. If it is uneven, the floor must be leveled before the cove base tile are set.

The wall of course must be marked for the cove base which must be perfectly level all the way around the room. Place a mark, by use of a level, on each wall at the height of the cove base row, as shown in Figure 42.

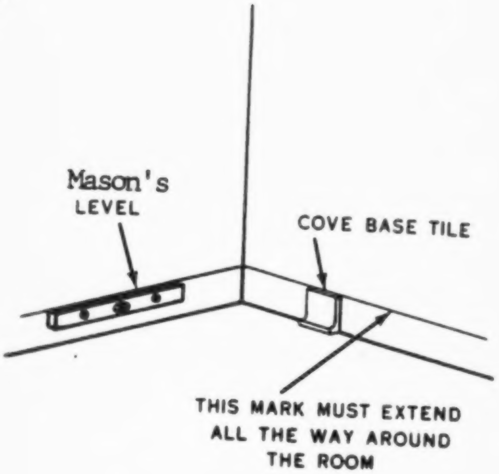

Figure 42. Marking the Cove Base Course

There are two ways to lay the tile out for the first row (cove base). In either case, first mark the center line of the wall, then you can start tile, as shown in Figure 43A, or as shown in Figure 43B. Use the method that will require the least cutting. If possible, place cut edges of tile in a corner where they will not be too obvious. The center line should be marked the height of the tile work. The area around the bathtub should be tiled at least one row higher than the shower head. The walls around the lavatory should be tiled at least two courses higher than the lavatory. Ordinarily the side walls are tiled to a height of 50 to 51 inches (10 courses plus the edging cap and the cove base).

Tiling a Wall Using an Adhesive. To tile a wall using the adhesive method, spread the tile adhesive on the wall with a trowel, as shown in Figure 44. Hold the trowel at an angle of approximately 30° and it will leave the proper amount of adhesive on the wall.

Using this adhesive, you can set wall tile directly on gypsum wallboard, plaster, brick, masonry, concrete, plywood, and asbestos board surfaces that have been primed with a primer or shellac. Apply adhesive to the wall. Do not leave any bare spots on the surface. Most tile adhesive will set up in about 30 minutes, so don't apply the tile adhesive to a larger area than you can finish within that time. Since there are different types of tile adhesive, follow the manufacturer's instructions printed on the container.

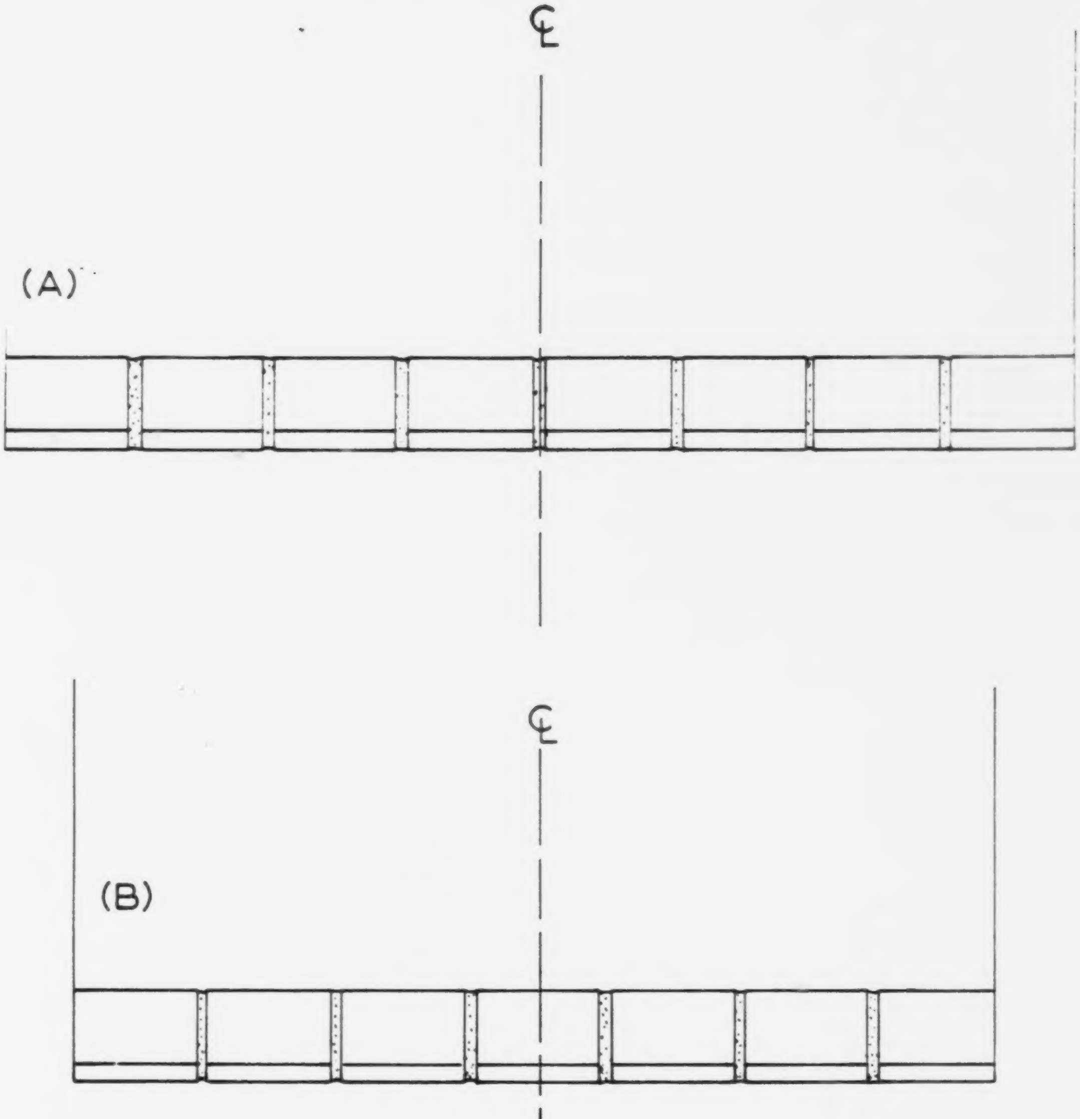

Figure 43. Laying Out Tile

From time to time it may be necessary to apply the adhesive directly to the tile. This is called buttering and consists of applying the adhesive 1/16" thick in a 3" circle to the back of the tile. When this method is used at least 60 percent of the tile is covered with the adhesive. When tiling a wall always set the cove base tile first. Set the cove base tile and check to assure it is level with a mason's level. Apply the wall tile in level rows on top of the cove base starting at the center line and set the tile toward the corners. You may have to cut them to form in the corners but this will help to keep the tiles along the center line plumb, even if the corners are not plumb. Make certain that the friction bars (ridges) on the

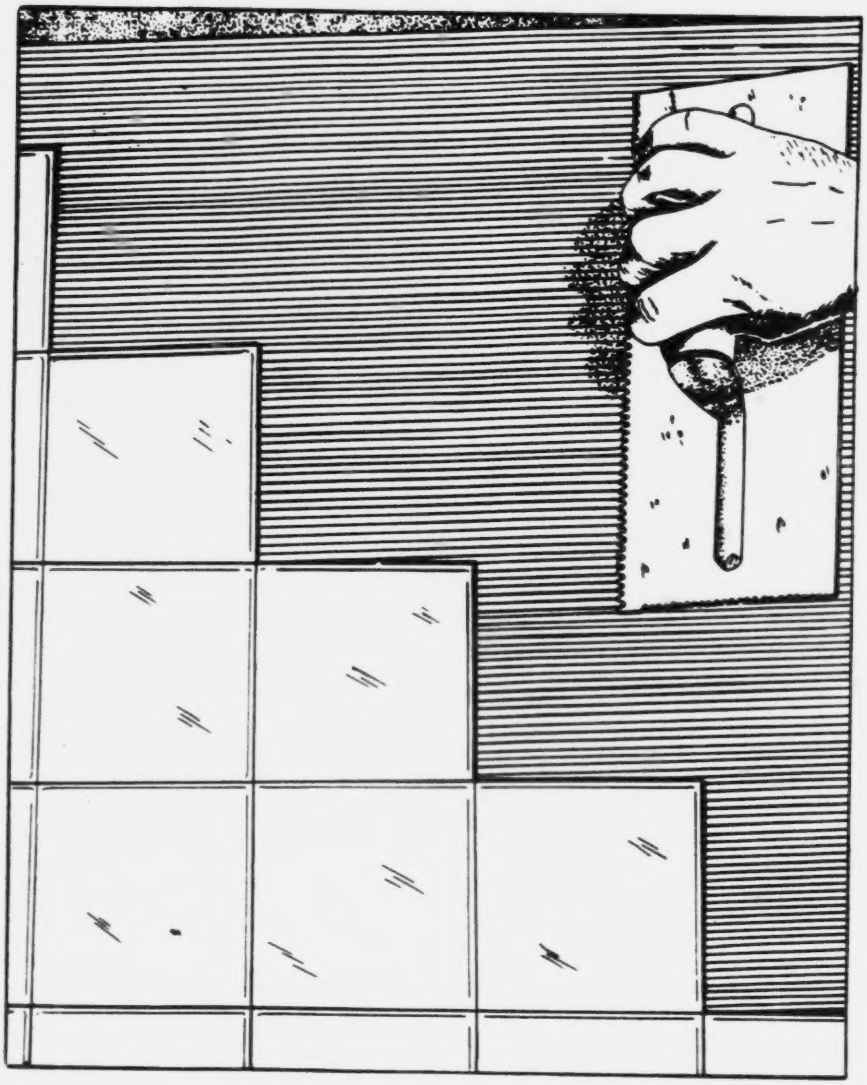

Figure 44. Spreading Adhesive with a Notched Trowel

back of the tile are horizontal. Tap the tile lightly with the handle of your trowel as you set it on the wall. This will set the tile firmly enough to keep it in place. Continue setting the wall tile until you have one row extending the length of the wall to be covered. After completing the first row, check the joints to make sure they are all the same width. Use the point of your pointing trowel to adjust any tile that are not spaced properly.

Some ceramic tile is manufactured without the lugs. These tile are spaced with small rubber spacers, pieces of wooden spoons, toothpicks, or stirrers of the correct thickness. These can be broken into parts and inserted between the tile to serve as spacers, see Figure 45.

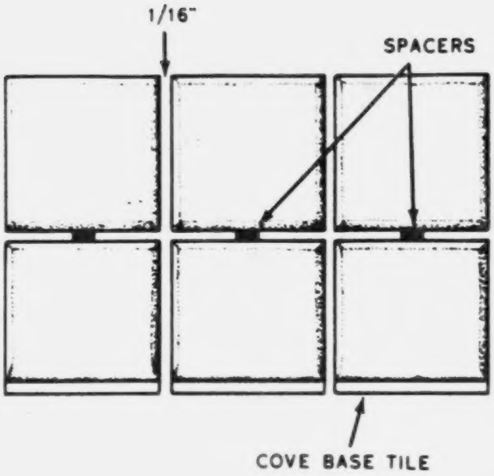

Figure 45. Tile Spacers

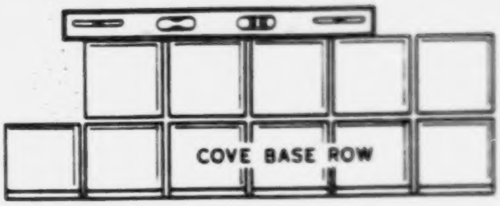

Figure 46. Leveling Wall Tile

After you have laid one complete row of wall tile, place a level on top of the tiles to make sure they are level. The proper method of leveling tile is shown in Figure 46. If the reading is level, push up any low tiles to the bottom edge of the level by raising them with the point of your pointing trowel. Place a rubber spacer under the tiles you lift to hold them in place until they set. If the tiles are not level, raise them up against the level until you get a level reading. After you get the level reading, bring the remaining tiles to the line established by your level.

When the first row of tile is level, set a few rows using the same procedures. Level the rows as you complete them. After the tile wall is raised to the desired height, according to the drawings and specifications for the job, butter and set the bullnose cap at the top of the tiled surface. Aline vertical joints by eye. After all the tile are set take a straightedge (short board) and hammer and beat and float the tile.

To beat the tile into a smooth surface, hold the block at one end with the flat side against the surface of the tile. Then move the block along the wall and beat the tile, as shown in Figure 47. After completing the beating operation, clean the tile joints to allow room for the grout material. The purpose of floating a tiled surface is to aline the tile and space the joints like they were before they were beaten in. During the process of beating the tile, you set up vibrations that could being moisture to the surface (back of the tile) and cause some of the tile to be loose. To get these tile back in

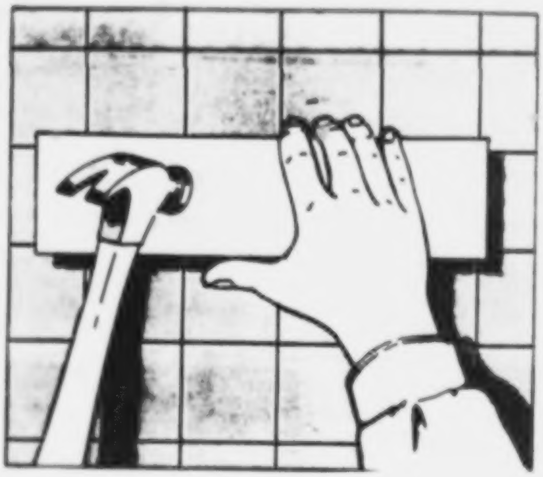

Figure 47. Beating the Tile

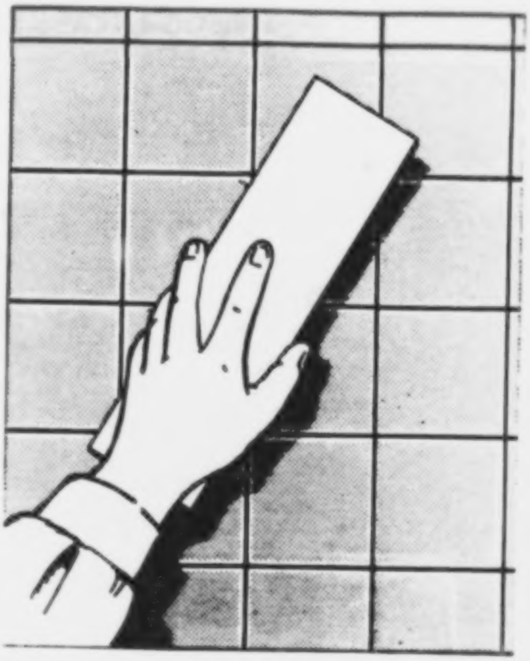

Figure 48. Floating the Tile

their proper position, you must gently float the tiled surface. To do this, hold the block with the flat face against the tiled surface and move it back and forth applying very little pressure, as shown in Figure 48. Adjust the space between the joints with the point of your pointing trowel. Allow the tile to set for at least 30 minutes, while you are mixing the tile grout.

Fitting Tile Around Obstacles. When tiling up a wall you may encounter pipes of fixtures that are to be tiled around, such as a bathtub. Leave 1/8" clearance between the wall tile and the pipes or tub (fixtures to be tiled around) for contraction and expansion.

Tiling a Wall Using the Plaster Method. This method is normally used in new construction. This method of tiling is not as popular as the adhesive method because of the amount of time required for installation.

Preparing the Surface. Preparing a wall surface to receive the tile is almost the same as preparing it to be plastered. Walls to be tiled (except masonry and plaster walls that have good suction and are in good condition) must be covered with lath.

After the base is properly secured, you can start mixing the mortar. There are three coats of mortar used to prepare a wall surface which is to be tiled: a scratch coat, neat coat, float or setting coat.

Applying the Scratch Coat. The scratch coat consists of 1 part portland cement to 3 parts sand, with the addition of 10 percent hydrated lime by volume of the cement used.

After properly mixing the materials for the scratch coat, apply the mortar to the base according to the thickness indicated on the drawings but in no case less than 3/8 inch thick. Apply it in the same manner as you applied plaster. While the mortar is still plastic, score or scratch the surface with a scarifier to provide a key for the float coat. Keep the scratch coat moist until it is damp set before applying the float coat.

Applying the Neat Coat. The coat consists of 1 part portland cement and 3 parts sand.

After properly mixing the float coat, use the mortar to fasten the base screeds (strips of wood 3/8 inch thick and 1 inch wide) securely against the scratch coat. To do this, apply a strip of mortar about 1/2 inch thick to the wall and press the base screed firmly against the mortar. This will temporarily hold the base screed in place. Then apply mortar to an area (against the sides of the base screed) 3 inches on each side of the base screed to be sure it will stay in place.

Like in plastering, the screeds will act as a guide to help you obtain a straight wall with a uniform thickness during the screeding process. Apply the float coat between the base screeds, and screed the surface off until it is level and plumb. Use a level and straightedge to make sure you have a true surface. Now you are ready to mix the neat coat and start setting the tile.

Applying the Float Coat. This coat consists of a mixture of portland cement and water mixed to a consistency of putty or a commercial type of cement mastic.

Before wall tile can be set it must be thoroughly soaked in water. Soak the tile in water for a minimum of 1 hour to prevent the tile from drawing moisture from the neat coat. There are two methods used for applying the float coat of portland-cement mortar, the floating method, and the buttering method.

The floating method consists of applying a skim coat of mortar about 1/16 inch thick to a section of wall surface that can be covered with tiles within 30 minutes. If the tile is not set within 30 minutes, the mortar will dry up and the tile will not adhere properly to the mortar. When the floating method is used, the tile must be snapped into place to force the air from behind the tile and obtain a good bond.

Using the buttering method, you apply about 1/16 inch of mortar to the back of each tile. When this method is used, at least 60 percent of the back of each tile must be covered with mortar, then it is set and tapped into place.

This section assures a good bond between the tile and the surface. (The buttering method is always used to set tile trim.) Now that you understand how to apply the float coat of portland-cement mortar, we will discuss the procedures for setting wall tile.

Setting the Tile. When tiling a wall, always set the cove base tile (tile at the base of bottom of the wall) first. Using the handle of your trowel, tap the tile to insure that the mortar is evenly spread behind it. Set the remaining cove base tiles in the same manner. The layout and alignment of these tile are the same as tile set using the adhesive method.

Apply the wall tile in level rows on top of the cove base by either the floating method or the buttering method. After the tiles are set they must be beat and floated before you grout the joints.

Beating the Tile. After tiles are set, they must be beat into place if a smooth wall surface is to be obtained. Variations in individual thicknesses and differences in depth to which the tiles have been set make it necessary to bring the whole surface into a uniform, smooth plane. The only tools needed for this operation are a hammer and a wooden block.

To beat the tile into a smooth surface, hold the block at one end with the flat side against the surface of the tile. Then move the block along the wall and beat the tile in.

After completing the beating operation, clean the tile joints to allow room for the grout material.

Floating the Tile. The purpose of floating a tiled surface is to aline the tile and space the joints like they were before they were beat in. During the process of beating the tiles, you set up vibrations that could bring moisture to the surface (back of the tiles) and cause some of the tiles to be loose. To get these tiles back in their proper position, you must gently float the tiled surface with a beating block.

Hold the block with the flat face against the tiled surface and move it back and forth, applying very little pressure. Adjust the space between the joints with the point of your pointing trowel. Allow the tiles to set for at least 30 minutes, while you are mixing the tile grout.

Preparation and Layout of Floor Tile

The success of a good tile floor job depends primarily on the condition of the floor you apply the tile to. Floor tile can be installed by the same two methods that are used for installing wall tile, the adhesive method and the cement mastic method.

Preparation of the Floor. Preparation of the floor consists of removing the fixtures and repairing or leveling the floor. When tiling a bathroom floor, it is usually timesaving to remove a commode but it is usually easier to tile around the bathtub. Remember if you tile around a fixture leave a space of 1/4 inch between it and the tile. Fill the space with grouting. This will provide for expansion and contraction of materials.

If you decide to tile under the commode, as shown in Figure 49, it will be necessary to use longer holddown bolts and either use an expansion on the floor flange or two wax rings around the discharge opening when you replace it. The tile needs to come to within 1/2" of the flange instead of the 1/4 inch when you tile around the commode.

After you have removed the fixtures you must decide which method you are going to use to install the tile. Floor tile must have a very firm base or they will work loose and crack. The method of installing floor tile is usually determined by the type of construction. If it is new construction, that section of the floor can be recessed so concrete can be poured to form a firm base, as shown in Figure 50. Notice how the subfloor is lowered so that the concrete base and ceramic tile will be flush with the finished floor. When laying tile on a concrete base such as this, the tile is normally installed by the cement mastic method. This method is very common in bathroom floor construction where water could be a problem.

If the building is already built, the flooring can be cut out with a power saw, but the easiest way to tile the floor is to cover it with a ½-inch to 3/4-inch plywood. Give the plywood a prime coat before applying the adhesive to set the tile, as shown in Figure 51. The floor, of course, is higher than the adjoining floor but bullnose or trim tile can be laid or a marble doorway saddle can be used to finish the tile edge, as shown in Figure 52.

Another type of installation consists of removing the old floor down to the subfloor and filling in with plywood of the correct thickness to bring the tile level with the original floor. Usually ½-inch or 5/8-inch plywood with building paper under it will make it the correct thickness; however, it depends on the thickness of the original floor.

If you are installing tile over a concrete surface, such as a concrete slab, that has already been poured, it should be roughened so that you can obtain a good bond for the tile.

Preparation of Doors and Door Casings. If you change the height of the floor by adding tile you will have to cut the inside door casing. This should be done before laying the tile. Figure 53 shows how the casings are marked so they can be cut off.

If the tile are laid directly on the floor, place a tile against the casing, as shown in Figure 53A, and mark it with a pencil. If you are covering a floor with plywood, mark the casing with a tile on top of a scrap of plywood, as shown in Figure 53B. When cutting the casing, do not saw through the other side of the casing. The door is marked by placing the saddle against it, as shown in Figure 54.

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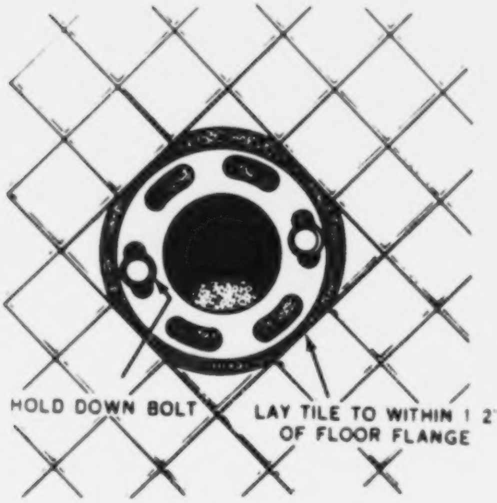
HOLD DOWN BOLT
LAY TILE TO WITHIN 1 2"
OF FLOOR FLANGE

Figure 49. Tiling Under a Commode

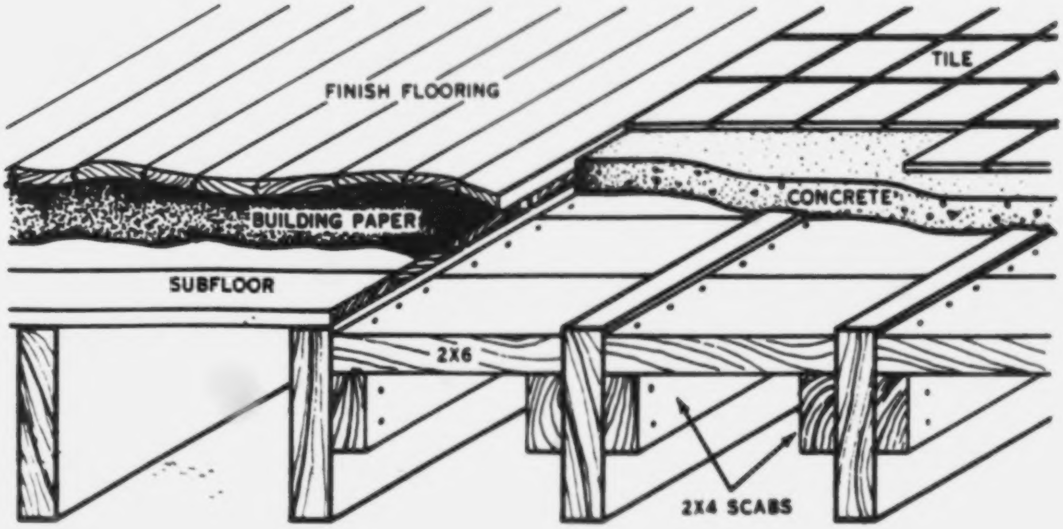
FINISH FLOORING
TILE
BUILDING PAPER
CONCRETE
SUBFLOOR
2X6
2X4 SCABS

Figure 50. Recessed Concrete Base

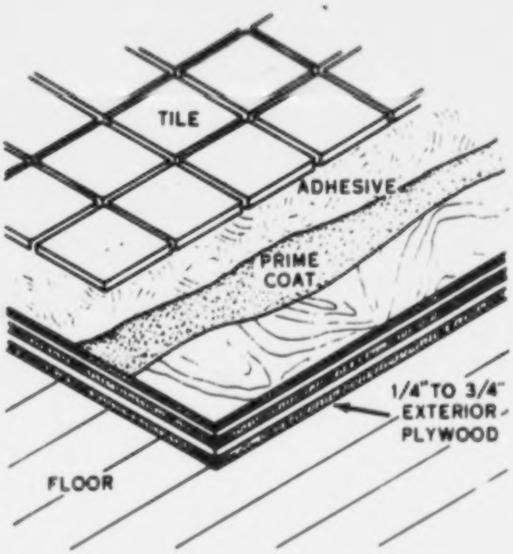
TILE
ADHESIVE
PRIME COAT
1/4" TO 3/4" EXTERIOR PLYWOOD
FLOOR

Figure 51. Preparing an Existing Floor for Floor Tile

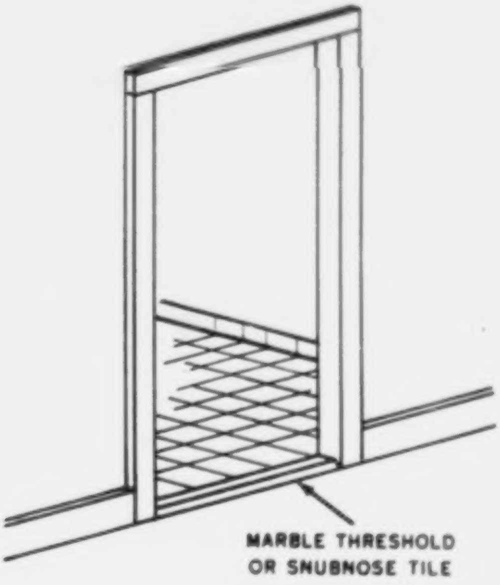
MARBLE THRESHOLD OR SNUBNOSE TILE

Figure 52. Finishing Doorway with a Saddle

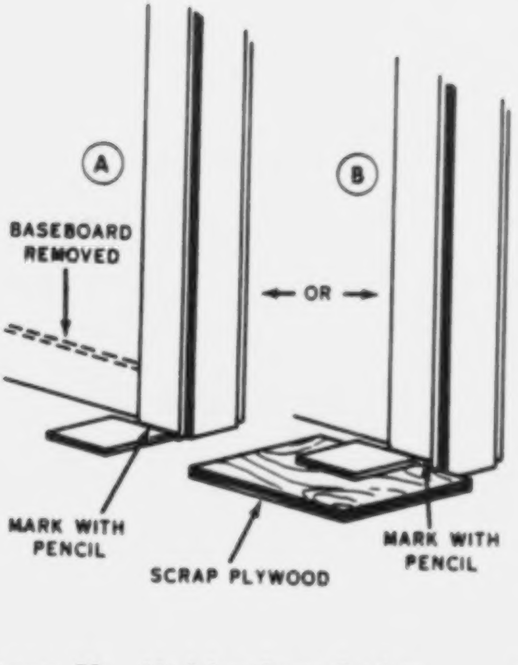
A
B
BASEBOARD REMOVED
OR
MARK WITH PENCIL
SCRAP PLYWOOD
MARK WITH PENCIL

Figure 53. Marking Door Casing

Allow at least 1/2 inch clearance for the door to swing.

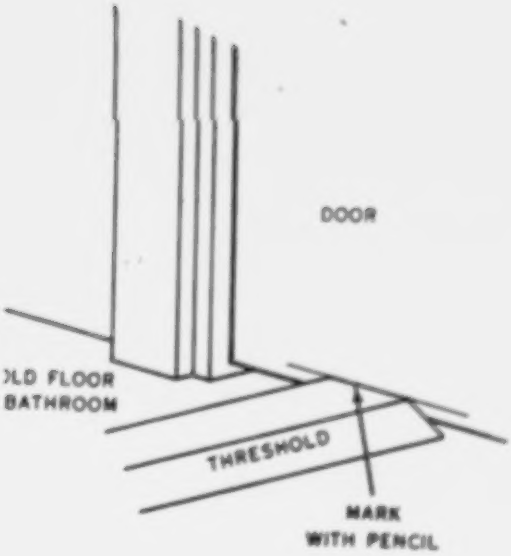

Figure 54. Marking the Door

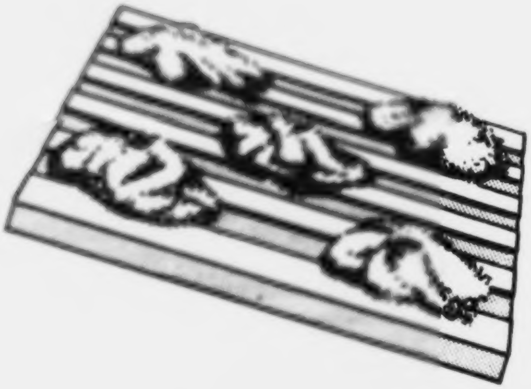

Figure 55. Buttering Quarry Tile

Laying Out the Job. Before you start setting floor tile, check the room for squareness. If it is square measure and mark the center of both walls and snap a chalk line across the length and width. If the room is not square try to plan your tile so the cut tile will be in an inconspicuous corner, such as behind the commode. Once the room is quartered, layout the tile in the pattern desired to see if any tile will need cutting or if the chalk lines need to be adjusted to aid in fitting the pattern of tile. When the setting of the tile begins start from the center of the room and work each quarter until the entire area is tiled.

Setting Floor Tile. An adhesive mastic is usually used over wood surfaces while cement mastic is used over new or existing concrete surfaces. Preparation of the bedding surface needs to be done before setting the tile. Wood floors, such as plywood, must be sealed with a sealer or shellac following the same procedures as for wall tile. Concrete surfaces should be roughened for bonding purposes and sprayed with water where the tile are going to be set. This will prevent the concrete from absorbing water from the cement mastic used to set the tile.

Mosaic Tile. If an adhesive mastic is used, follow the same procedures as used in tiling a wall, i.e., hold the trowel at an angle of approximately 30° and it will spread the proper amount of adhesive. If cement mastic is to be used, soak the mosaic tile in water prior to use for several hours. When you are ready to use them stack them near the work area to permit drainage of any excess water. The cement mastic is spread 1/8" thick over a roughened, wet concrete surface. In both cases the sheets of mosaic tile are set in the mastic, being sure to place each sheet next to the other maintaining the same spacing and alignment. Care also needs to be taken to assure the pattern, if any, is placed in the same direction. Once the tile are set they need to be beaten and floated just like wall tile. If any tiles need realigned, move them laterally with a pointing trowel. Never lift the tile because it will break the bond and they will have to be reset.

Quarry Tile. Quarry Tile are usually set in a bed of cement mastic 1/4" thick, consisting of a mixture of 1 part portland cement to 3 parts fine sand. After properly mixing the materials, spray the concrete slab with water where the tile is going to be set. This will prevent the concrete from absorbing water from the mortar used to set the tile. Repeat the wetting of the slab at intervals if the concrete surface tends to dry out.

There are two ways of setting quarry tile, one in a 1/4 full bed of mortar and the other is buttering the tile. It consists of placing five small mounds of mortar on the back of each tile, as shown in Figure 55. Using your trowel, apply a small mound or mortar on each corner and one in the center of the tile. Then turn the tile over, set it on the slab, and tap it lightly with the handle of your trowel or a mallet; this will spread the mortar evenly over the bottom of the tile. To aid in keeping the tile straight and aligned string a mason's line along the front edge of the tile. Set the tile strating at the center and work towards the walls. When the first row of tiles is set, place a straightedge or a long level over them and adjust the tile by lifting them (adding mortar) or by tapping them down (beating them in) with a mallet until the row is level. Check the tile to be sure it is level. Normally, ½-thick joints are used between quarry tile, so set the remaining tile in the first row 1/2 inch apart, using small pieces of wood as spacers. The beating in and floating of tile set in cement mastic can be done in one operation. Be sure the tiles are seated by using a wooden block and striking it with a hammer. If the tiles need realining, move them laterally by inserting a wedge between them and sliding the tile. Never lift the tile because it will break the bond and have to be reset.

Grouting. Grouting seals the joints in between the tiles and gives the surface a finished appearance. The success of any tile job depends greatly on the application of the grout.

Grouting Wall Tile. Wall tile should be grouted after the wall tile have set a minimum of 30 minutes. It is best to wait a period of 24 hours before grouting the tile. The grout can be portland cement or a commercial grout.

To mix the grout, pour about 1 inch of water into a clean bucket and add about 2 or 3 handfulls of white portland cement or commercial grout.

Add enough grout to make a thick paste. The paste is mixed thick because the tiny lumps will mix easier when the mix is thick. After the grout is thoroughly mixed, add enough water to give the mix a thin, creamy consistency. To apply the grout to the tile joints, use a water brush (long fiber paint brush), sponge float, rubber float, or a squeegee; dip whichever tool is used into the grout and then go across the grout joints in various directions (both with and across the joints) until the grout is flush with the surface of the tiles. If the joints are not taking the grout - readily add a little more water. This will make the grout thin enough to penetrate every joint. When all of the joints are filled flush with grout, use the jointer to compact the grout as shown in Figure 56. This jointer, which is made of plastic, works in a manner similar to the one you used on brick joints. During the process, grout will appear on the surface of the tile.

Washing. Wash the tile with a clean brush and a bucket of water. Wet the brush and wash the surplus grout from the tile. After going over the surface a couple of times with the water brush, wipe the surface thoroughly with a squeegee, as shown in Figure 57. After nearly all the grout is removed from the surface of the tile, finish smoothing off the joints by gently rubbing over them with a damp cloth.

Try to bring all joints to an even depth of 1/32 inch below the surface of the tiles. As the tile joints dry (cure), work the joints over lightly with a damp cloth to prevent them from drying too fast, thereby causing the grout to crack.

As long as the joints are rubbed with a damp cloth, there will be a thin film of grout on the tiles. When the tile joints are properly cured, clean the tiles by rubbing them with a soft dry cloth.

Grouting Floor Tile. If the tile such as mosaic are set like wall tile with adhesive mastic then wait a minimum of 30 minutes before grouting. You should grout floor tile set with cement mastic within 2 or 3 hours after they are set so that a good bond will be obtained between the mastic used to set the tiles and the cement grout. When grouting quarry tile, you can prepare the grout mixture with the same ingredients as the cement mortar used to set the tile or with white portland cement grout.

The grout mixture for quarry tile is made up of 1 part portland cement to 2½ parts sand. Add enough water to the mix so that it has a creamy consistency. Before grouting the tile, remove the wood spacers. After grouting a section of the tile joints, rub a wet cloth over them to force the grout into the joints so that they are filled just below the surface, approximately 1/32 of an inch. Continue this procedure until all of the joints are grouted.

Washing the Tile. When grouting is completed, wait about 30 minutes and wash the tile with a wet cloth to remove any cement spots on the tile. Then rub over the tile with a dry cloth.

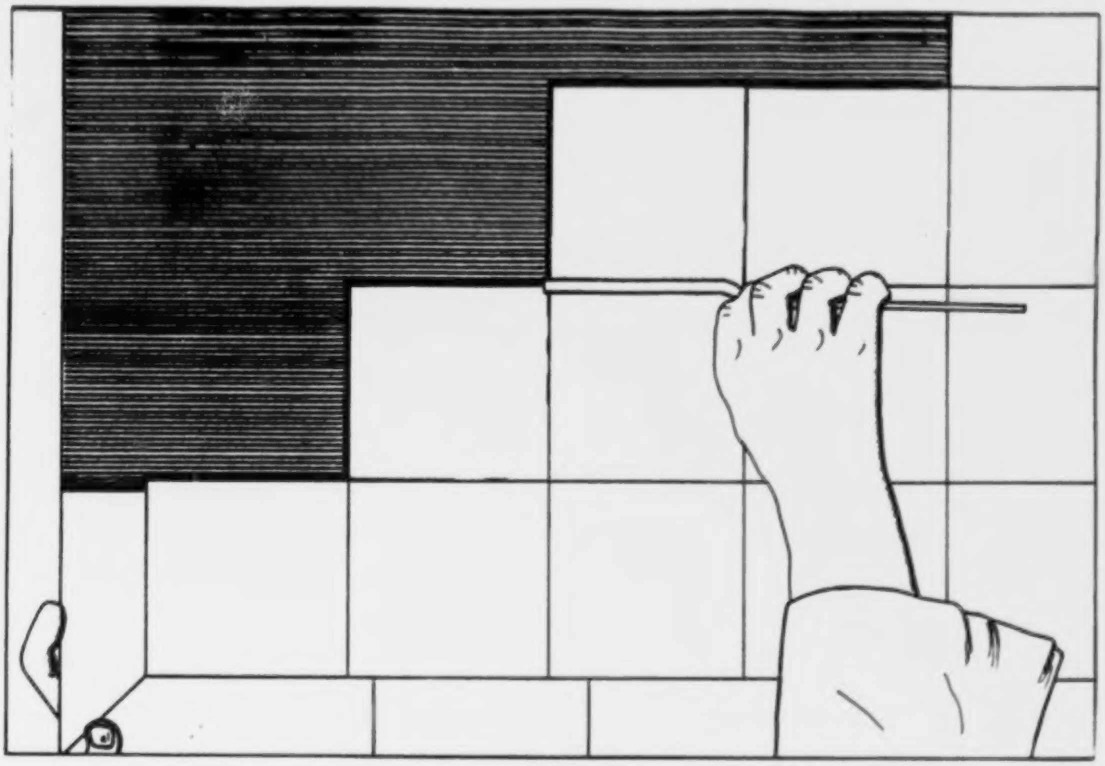

Figure 56. Jointing Grouted Tile Joints

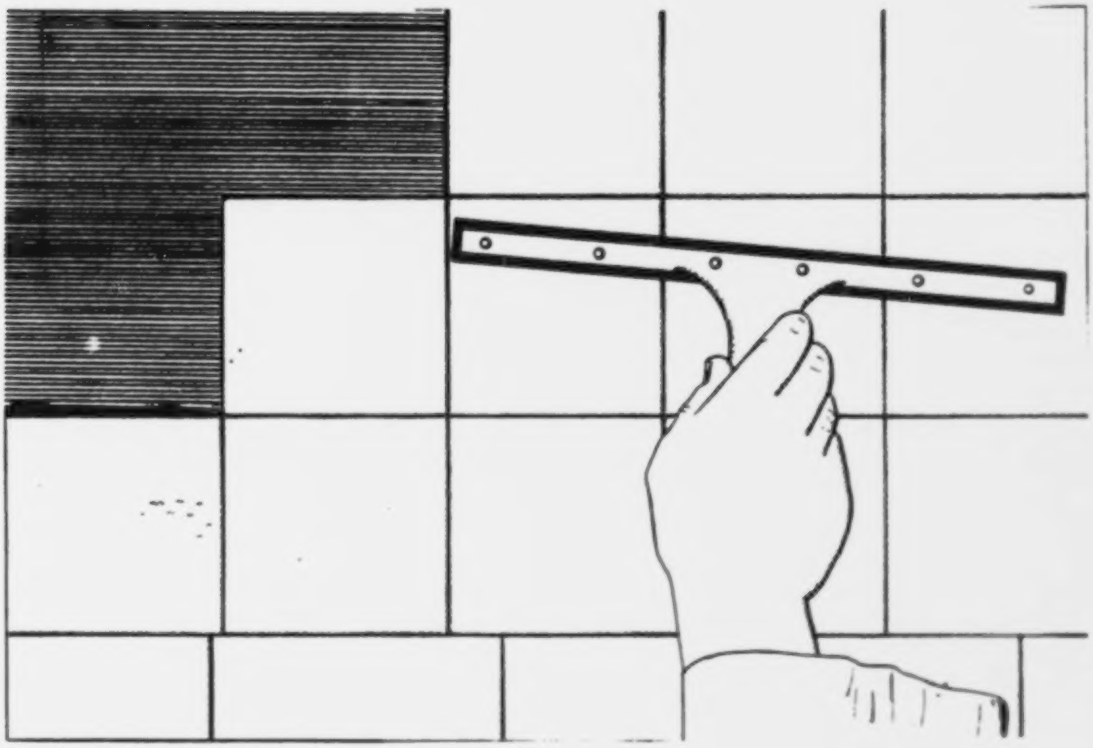

Figure 57. Cleaning Tile with a Squeegee

Curing the Tile Joints. You can cure the cement mastic joints by placing wet burlap bags over the surface for 24 hours to keep the grout from cracking. When you remove the burlap bags, wash the tile with water once again. If the cement grout causes discoloration of the tile, the true color of the tile can be restored by applying one or more coats of linseed oil. Otherwise cure the joints as you would wall tile.

SUMMARY

The term "ceramic tile" can mean many types and shapes of ceramic tile; glazed tile for wall, nonglazed for floors. All walls and floors should be laid out before mastic is applied. Never apply more than you can cover before mastic dries. Cut material should be laid to one side within easy reach. When grouting, make sure all joints are full, neat and clean.

QUESTIONS

Refer to your assignment materials and answer the following questions.

1. What is the difference between ceramic wall tile and ceramic floor tile?
2. When placing a floor, what two types of tile could be used?
3. What class of tile will absorb less than 3 percent of its weight in moisture?
4. What is the most common size of ceramic tile?
5. What are the lugs on ceramic wall tile used for?
6. Glazed exterior tile are of what class?
7. What class of tile resists the absorption of water?
8. What type of tile are small, multicolored squares, rectangles or other shapes positioning on sheets to form a pattern?
9. What is added to tile to form a nonslip surface?
10. A nonvitreous tile will absorb ________________________________.

WORKBOOKS

J3ABR55231 000-III-1-P1 thru 5-P6

TECHNICAL TRAINING

Masonry Specialist

PLASTER, STUCCO, AND TILE

May 1983

USAF TECHNICAL TRAINING SCHOOL
3770 Technical Training Group
Sheppard Air Force Base, Texas 76311

Designed for ATC Course Use

DO NOT USE ON THE JOB

ATC FORM 214 (JAN 76) OBSOLETES ATC FORMS 214, MAY 69, 522, NOV 63 AND 523, MAY 71. STANDARD COVERSHEET

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Supersedes WBs J3ABR55231 000-III-1-P1 thru 2-P5, November 1981

3770 Technical Training Group
Sheppard Air Force Base, Texas

WB J3ABR55231 000-III-1-P1
May 1983

VULNERABILITY OF AFSC 552X1 TO OPSEC VIOLATIONS

OBJECTIVE

Given a list of operational activities related to AFSC 552X1, select the activities indicating OPSEC vulnerabilities for AFSC 552X1.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-1	1/student
WB J3ABR55231 000-III-1-P1	1/student

PROCEDURE

Given a list of operational activities related to AFSC 552X1, select the activities indicating OPSEC vulnerabilities for AFSC 552X1.

MISSION I

1. The program OPSEC means ____.

2. The goal of the OPSEC program is to prevent __________________________

__________________________ and existence of these forces or operations.

3. List six ways in which our intelligence data could be compiled by foreign agents.

   a. ____

   b. ____

   ____

   c. ____

   d. ____

   ____

   e. ____

   ____

   f. ____

4. What channels are available for the masonry specialist to report suspected security violations?

____

____

5. The four types of security threats are:

a. ____

b. ____

c. ____

d. ____

6. Every member of the Armed Forces is a potential target for espionage because each possesses access to ________________________________

____.

7. If you know of any attempt to solicit information that could be of intelligence value, you should __________________________________

____.

MISSION 2

From the following list of operational activities related to AFSC 552X1, select those activities indicating OPSEC vulnerabilities by placing a check in the space provided.

______1. While working in a hangar, you observe several aircraft being camouflaged. You discuss this with a friend in a bar downtown.

______2. You study the plans for a new command post building and discuss construction methods with your supervisor.

______3. During a job in an alert facility, you learn that the entire base has been placed on alert status to support an overseas exercise.

______4. You mention to a friend that your latest job consisted of constructing new storage facilities for jet fuel.

______5. You tell your wife and kids about the huge, funny looking bombs you saw being loaded aboard an airplane today.

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BASE CIVIL ENGINEER ORGANIZATION AND CAREER FIELD ORIENTATION

OBJECTIVE

Given a chart of the CE organizational structure and a list of CE functions, describe the mission, organization, functions and responsibilities of a civil engineering organization.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-2	1/student
WB J3ABR55231 000-III-2-P1	1/student

PROCEDURE

Given a chart of the CE organizational structure and a list of CE functions, describe the mission, organization, functions and responsibility of a civil engineering organization.

MISSION I

1. Using Figure 1, in your studyguide fill in the names of the shops in the structures section of the Base Civil Engineer Organization Chart on the next page.

a. ________________

b. ________________

c. ________________

d. ________________

e. ________________

f. ________________

2. For a base civil engineering organization to meet its mission, it is responsible for ____.

3. List the seven major functional sections that make up a civil engineering organization.

a. ______________________ e. ______________________

b. ______________________ f. ______________________

c. ______________________ g. ______________________

d. ______________________

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Base Civil Engineer Organization Chart

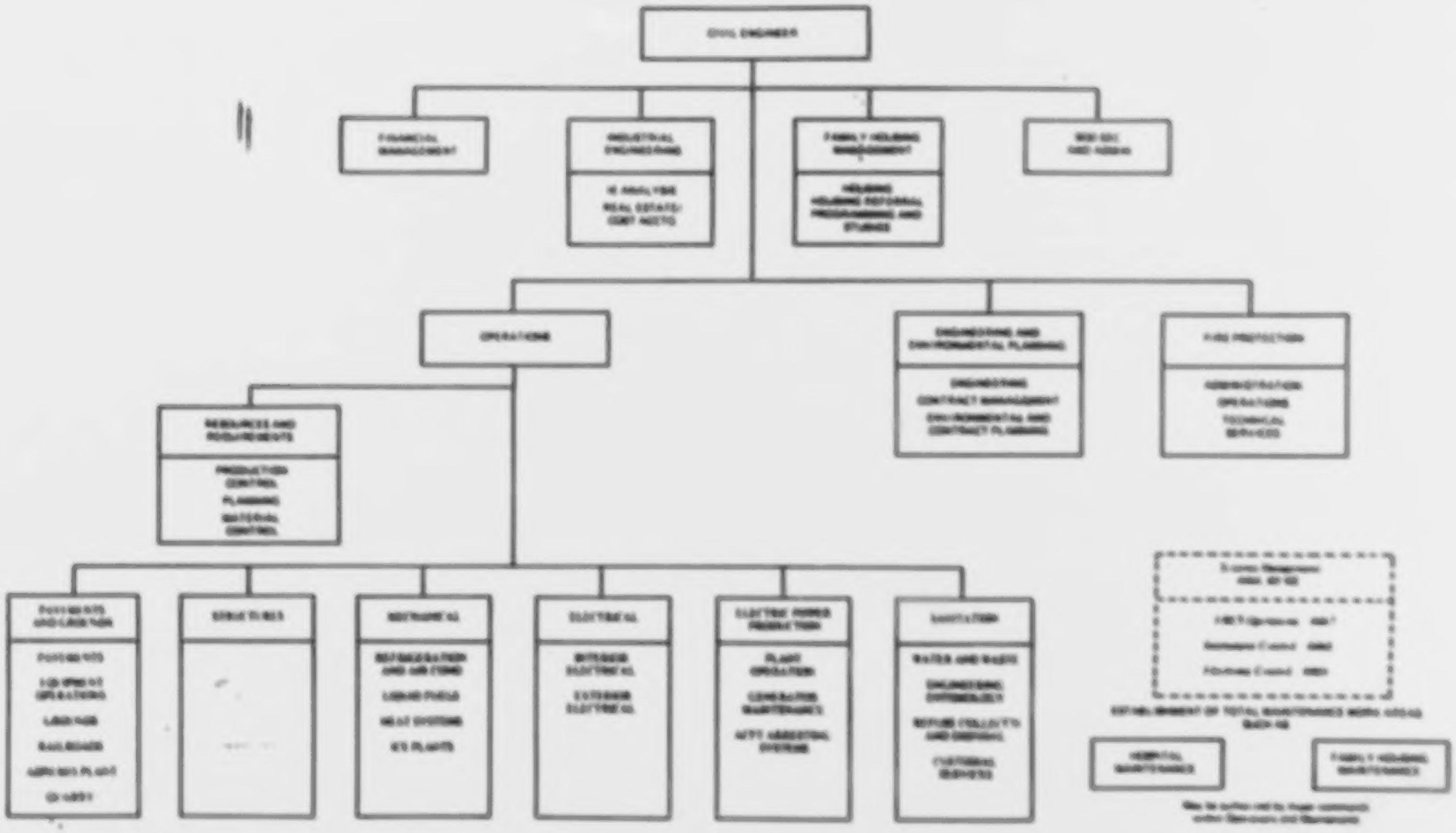
CIVIL ENGINEER
FINANCIAL MANAGEMENT
INDUSTRIAL ENGINEERING
FAMILY HOUSING MANAGEMENT
OPERATIONS
RESOURCES AND REQUIREMENTS
FIRE PROTECTION
STRUCTURES
MECHANICAL
ELECTRICAL
ELECTRIC POWER PRODUCTION
SANITATION

Figure 1. Base Civil Engineer Organization Chart

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4. Civil Engineering has a direct combat support role. This is the reason for assigned military personnel. You fulfill this role by being a member of a ______________________ team.

5. If you were assigned to a squadron that performed only heavy repair and major construction, you would be assigned to a _______________ squadron.

6. Sewage plants and systems are under what section of the BCE organization?

7. Who commands the BCE organization?

8. What are the major work areas under operations?

a.
b.
c.
d.
e.
f.

9. Name the three areas where a masonry specialist could be assigned to perform their duties.

PROPERTY ACCOUNTABILITY AND RESPONSIBILITY

OBJECTIVE

Given information, identify responsibilities and procedures for security and accountability of CE property.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-2	1/student
WB J3ABR55231 000-III-2-P2	1/student

PROCEDURE

Given information, identify responsibilities and procedures for security and accountability of CE property.

MISSION I

1. Who is responsible for public property in possession of the Air Force?
2. What are the three types of responsibilities?
3. What is pecuniary liability?
4. What is the title of Air Force Regulation 67-10?
5. Who is responsible for all property issued to BCE organizations?

STRUCTURAL/PAVEMENTS ORGANIZATION

OBJECTIVE

Given information, describe the organization of the structural/pavements career field.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-2	1/student
WB J3ABR55231 000-III-2-P3	1/student

PROCEDURE

Given information, describe the organization of the structural/pavements career field.

MISSION I

1. What identifies people to the structural/pavements career field?

2. Describe the duties of the structural/pavements career field.

3. Why are personnel serving in this career field subject to deployment?

CAREER LADDER PROGRESSION

OBJECTIVE

Using information provided, describe the duties and responsibilities of AFSCs 55231/51 and the requirements for career ladder progression.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-2	1/student
WB J3ABR55231 000-III-2-P4	1/student

PROCEDURE

Using information provided, describe the duties and responsibilities of AFSCs 55231/51 and the requirements for career ladder progression.

MISSION I

1. To locate the duties and responsibilities of a masonry specialist which Air Force Regulation would you use?

2. Using the following breakdown of AFSC 55251 refer to your Study Guide and identify the meaning of the five digits used?

a. 55____

b. 2____

c. 5____

d. 1____

3. Using Figure 4 in the Study Guide, list two tasks from each paragraph on the duties and responsibilities of a masonry specialist.

____

____

____

____

____

____

4. Complete the following items by entering the duty AFSC and the title of each AFSC for the statements listed below.

a. A chief master sergeant from the masonry career ladder must possess what AFSC and duty title?

____

b. Upon promotion to staff sergeant, which AFSC will you start to be trained into?

____

5. A dual channel training program consists of what?

6. To be promoted to senior airman (E-4) what AFSC must you have?

7. How long do you have to be on OJT before being upgraded to the 5 level?

PREPARING FOR PLASTER OR STUCCO

OBJECTIVE

Using information provided, identify the materials used in processing mortar and plaster mixes.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-3	1/student
WB J3ABR55231 000-III-3-P1	1/student

PROCEDURE

Using information provided, identify the materials used in processing mortar and plaster mixes.

MISSION I

1. Plaster and stucco is a combination of ______________________________.

2. The three main cementing agents in plaster are ______________________,

______________________, and ________________________.

3. What effect do admixtures have on plaster?

4. What will too much water in the base coat cause?

5. Plaster is normally applied in three coats, what are they?

6. When plaster is applied to an exterior it is called?

7. What is the most common material used for a plaster base?

8. Why would you use a screed when plastering a wall?

9. What is the purpose of a ground?

10. How much of a masonry surface should be roughened for bonding?

MISSION II

Match the following by placing the letter of the answer from Column B beside the number of the Column A item or items that most nearly describe it. Each element in Column B may be used more than once, or not at all.

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Column A Situation	Column B Types of Base
_____1. Applying plaster to a surface that requires suction and mechanical bonding	a. Wood Lath
_____2. Applying plaster to a base that requires special furring nails.	b. Metal Lath
_____3. Applying plaster to a surface that requires dampening of the base material.	c. Metal Wire
_____4. Applying plaster to a base that has diamond shaped keys	d. Gypsum Board Lath
_____5. Applying plaster over a dash bond	e. Insulated Gypsum
	f. Masonry

LATH INSTALLATION

OBJECTIVE

Working individually, but as a member of a team and with instructor assistance for most parts of the task, install lath to receive plaster or stucco. The lath must be ready for a scratch coat of plaster or stucco.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-3	1/student
WB J3ABR55231 000-III-3-P2	1/student
Mason Hand Tools	1/student
Lath Material	1/12 students
Nails	1/student

PROCEDURE

Working individually, but as a member of a team and with instructor assistance for most parts of the task, install lath to receive plaster or stucco. The lath must be ready for a scratch coat of plaster or stucco.

MISSION I

1. Obtain the necessary tools for installing metal lath. List these tools.

____.

2. Secure the lath to the framework with appropriate securing devices.
3. Secure inside and outside corners as necessary.
4. Install screeds and grounds as necessary

MIXING AND APPLYING A SCRATCH COAT

OBJECTIVE

Working individually, but as a member of a team using masonry tools and with instructor assistance for most parts of the task, mix, test for consistency, and apply a scratch coat of plaster. Surface must be ready to receive a brown coat of plaster.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-3	1/student
WB J3ABR55231 000-III-3-P3	1/student
Mortar box	1/12 students
Mixing tools	1/12 students
Plaster materials	1/12 students
Mason Hand tools	1/student

PROCEDURE

MISSION I

1. Obtain the necessary tools, equipment and materials required for mixing plaster mortar.

   a. List the tools required: ______________________________
   ____

   b. List the ingredients of the mortar to be mixed: ______________________________
   ____

2. Screen and mix the ingredients in their proper proportions.

3. Examine the consistency.

4. Use a hawk and trowel and apply the plaster to the stud mounted lath.

   a. Apply sufficient plaster to key properly on the lath.

   b. Apply sufficient plaster to achieve minimum scratch coat thickness.

5. Scratch the surface to provide a good bond for the brown coat.

6. Establish the thickness reference for the coat.

   NOTE: Allow the scratch coat to dry but not harden before building the screeds for the brown coat.

7. Clean and store the tools and equipment.

MIXING AND APPLYING A BROWN COAT

OBJECTIVE

Working individually but as a member of a team and with instructor assistance for most parts of the task, mix, test for consistency, and apply a brown coat of plaster. Surface must be covered with no visible voids and must be ready for a finish coat or to receive tile.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-3	1/student
WB J3ABR55231 000-III-3-P4	1/student
Mortar Box	1/12 students
Mixing Tools	1/12 students
Plaster and materials	1/12 students
Mason Hand Tools	1/student

PROCEDURE

MISSION I

1. Obtain the necessary tools, equipment and materials required for mixing plaster mortar.

    a. List the tools required: ______________________________

    ____

    b. List the ingredients of the mortar to be mixed: ______________

    ____

2. Screen and mix the ingredients in their proper proportions.

3. Mix enough plaster mortar to cover the scratch coat.

4. Test for consistency.

5. Use a hawk and trowel and apply the plaster to the scratch coat.

    a. Apply sufficient plaster to properly bond to the scratch coat.

    b. Apply sufficient plaster to achieve minimum brown coat thickness.

6. Scarify the brown coat, or leave the surface smooth.

7. Establish the thickness references for the finish coat.

8. Clean and store the tools and equipment.

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MIXING AND APPLYING A FINISH COAT

OBJECTIVE

Working individually, but as a member of a team, observing safety procedures and with instructor assistance for most parts of the task, mix, test for consistency, and apply a finish coat. Surface must be covered with no visible voids and have a smooth or textured surface.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-3	1/student
WB J3ABR55231 000-III-3-P5	1/student
Mortar Box	1/12 students
Mixing tools	1/12 students
Plaster materials	1/12 students
Mason hand tools	1/student

PROCEDURE

MISSION I

1. Obtain the necessary tools, equipment, and materials required for mixing plaster mortar.

   a. List the tools required: ______________________________

   ____

   b. List the ingredients of the mortar to be mixed: ______________

   ____

2. Screen and mix the ingredients in their proper proportions.

3. Test for consistency.

4. Apply the finish coat to the brown coat in sufficient thickness to allow the final surface to be textured.

   a. The finish coat thickness should not be less than 1/8-inch.

   b. Wet the brown coat, if required.

5. Use the appropriate tools and techniques to create the specified finished appearance.

6. Clean and store the tools.

MISSION II

1. When should the screeds for the finish coat be formed?
2. What is used to wipe out the angles (corners) on a finish coat?
3. How can a texture be applied to the finish coat?
4. What type of finish coat mixtures are used by most plasterers?
5. A putty coat finish consists of?

MAINTAINING AND REPAIRING PLASTERED SURFACES

OBJECTIVE

Working as a member of a team, using tools provided, and with instructor assistance for most parts of the task, inspect a plastered surface and identify and determine the cause of any damage, then repair the areas bringing them back to within 70% of original condition.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-3	1/student
WB J3ABR55231 000-III-3-P6	1/student
Mortar box	1/12 students
Mixing tools	1/12 students
Plaster materials	1/12 students
Mason hand tools	1/student

PROCEDURE

MISSION I

NOTE: The instructor will direct you to a damaged plastered surface. Inspect the damaged surface and answer the following questions.

1. Name this type of damage. ____

2. What caused this damage? ____

____

MISSION II

1. Using the appropriate tools, prepare the crack for repair.
2. Determine the type and amount of patch material to be used.
3. Mix the patch material.
4. Apply and finish the repair surface.
5. Clean and store the tools.

MISSION III

Match the following by placing the letter of the Column B item beside the number of the Column A item or items that most nearly describe it. Each element in Column B may be used once, more than once, or not at all.

Column A	Column B
_____ 1. Applying a creamy mixture to a crack with a paint brush	a. Structural cracks
_____ 2. Replastering with the same materials as original job	b. Shrinkage cracks
_____ 3. Repairing a job that consists of several small lined cracks	c. Loose plaster
_____ 4. Use the same materials and procedures to repair as map cracks	d. Map cracks
_____ 5. Replastering a job caused by a plumbing leak	
_____ 6. A crack that extends all the way thru the plaster	
_____ 7. Indicated by bulging and cracking of large areas	
_____ 8. Caused by too rapid drying of the surface	

MISSION IV

1. What are some of the causes for plaster cracking?

2. To what extent should material from a structural crack be removed to effect a good repair job?

3. What is the proper procedure for repairing map and shrinkage cracks?

4. What corrective action must be taken before repairing plaster that has been loosened by moisture?

USING STANDARD PUBLICATIONS

OBJECTIVE

Given AFR 0-2 and a list of publication numbers and titles, locate desired information in the numerical index, with instructor assistance for most parts of the task.

Given a commercial publication and a list of masonry tools and equipment, locate desired information in the commercial publication, with instructor assistance for most parts of the task.

Given an Air Force regulation, manual, and pamphlet, locate desired information in the publication, with instructor assistance for most parts of the task.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-4	1/student
WB J3ABR55231 000-III-4-P1	1/student
AFR 0-2	1/2 students
AFR 85-1	1/2 students
Commercial Publication	1/2 students

MISSION I

PROCEDURE

Given AFR 0-2 and a list of publication numbers and titles, locate desired information in the numerical index, with instructor assistance for most parts of the task.

1. The AFR 0-2 is an Air Force ______________________________.

2. This regulation is dated ____________________ and supersedes the one dated ________________.

3. An "Explanation of Symbols" is found on page ______________.

4. Why are the letters M, R and P placed in front of the publication numbers in AFR 0-2? ____
____.

5. Current distribution symbols are ______________________________
____.

6. Below is a list of standard publication numbers. Locate the numbers in the AFR 0-2 and record the title for each one in the space provided.

a. AFP 50-6 ____________________

b. AFR 127-12 ____________________

c. AFR 92-1 ____________________

d. AFR 39-29 ____________________

e. AFVA 205-1 ____________________

f. AFM 400-2 ____________________

g. AFM 85-16 ____________________

h. AFP 211-10 ____________________

7. Below is a list of standard Air Force publication titles. Locate the titles in AFR 0-2 and record the number of each in the space provided.

a. ____________________ Support for Civil Air Patrol.

b. ____________________ Air Force Academy Preparatory School.

c. ____________________ Wartime Search and Rescue Procedures.

d. ____________________ Flight Weather Briefing.

e. ____________________ Preventive Dentistry Program for Children

MISSION II

PROCEDURE

Given a commercial publication and a list of masonry tools and equipment, locate desired information in the commercial publication, with instructor assistance for most parts of the task.

Using a GOLDBLATT CATALOG, refer to the general index and locate the following tools and the cost of each. Enter this information in the blank spaces provided below. Each item must be answered correctly.

ITEM	PAGE NUMBER	COST
a. Concrete mixer, 5 cubic feet capacity	____________	____________

	ITEM	PAGE NUMBER	COST
b.	Brick bath brush, 7½" X 3 3/4", trimmed 1½"		
c.	Bricklayers' Hammers, 12 oz., head		
d.	Cement Mason's Apprentice Tool Kit		
e.	Masonry Drill, ½" Dia., 6" drill length, ½" Shank Dia.		
f.	Mortar Hoe, 5½" handle, 10" Blade		

MISSION III

PROCEDURE

Given an Air Force Regulation, manual, pamphlet, locate desired information in the publication, with instructor assistance for most parts of the task.

Using AFR 85-1, find the answers to the following questions or statements. Also give the page and paragraph number references for your answers.

1. In a civil engineering organization, who is responsible for the management of the prime base engineer emergency force (Prime BEEF) contingency planning, disaster recovery, and readiness training programs? ______________________________

____

2. Which section of each chapter is directive in nature and does not contain optional procedures? ______________________________________

____

3. Define an Urgent Job Order by giving the time limit required for accomplishment.

____

____

Using AFP 85-1, locate the answers to the following questions or statements. Also give the page number reference for your answer.

1. When using a ladder, you should not lean your body more than ____________ beyond the side rail.

2. Are goggles required when trimming thorny trees? ________________________

3. If you should touch poison oak, what should you do at once? ____________

____

Using AFM 91-31, locate the answers to the following questions or statements. Also give the page number reference for your answer.

1. What is the responsibility of Major Command Level?

____

____

2. When using steed decks, they should be shop coated or ________________

3. Slate roofing has been produced for more than ____________ years.

CUT, DRILL, AND SHAPE TILE

OBJECTIVE

Given specifications and the tools and equipment for tile work, and observing safety precautions, cut, drill and shape ceramic tile, with instructor assistance for most parts of the task.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-5	1/student
WB J3ABR55231 000-III-5-P1	1/student
Power tile saw	1/12 students
Tile cutter (manual)	1/4 students
Hand tile nippers	1/student
Electric drill	1/6 students
Mason hand tools	1/student

MISSION I

PROCEDURE

Given specifications and the tools and equipment for tile work, and observing safety precautions, cut, drill and shape ceramic tile, with instructor assistance for most parts of the task.

CUTTING TILE WITH A POWER SAW

1. SAFETY PRECAUTIONS

    a. Remove all jewelry.

    b. Keep your hands away from the saw blade.

    c. Wear goggles while operating the saw.

    d. Keep all personnel away from the working area.

    e. Keep the work area clear of debris.

2. PREOPERATIONAL CHECK

    a. Check the tightness of the blade.

    b. Check the water supply.

    c. Check the moving parts for freedom of movement.

3. OPERATIONAL PROCEDURES
    a. Mark the tile to be cut.
    b. Position the tile.
    c. Start the saw.
    d. Move the saw slowly through the tile.
4. POST-OPERATIONAL CHECK
    a. Shut off the engine.
    b. Shut off the water.
    c. Disconnect the power supply.
    d. Visually inspect the saw.
    e. Clean the saw.

CUTTING TILE WITH A TILE CUTTER

1. Mark the tile to be cut
2. Position the tile
3. Score the tile
4. Break it by pressing down on the handle
5. Clean the tile cutter

DRILLING TILE WITH AN ELECTRIC DRILL

1. SAFETY PRECAUTIONS
    a. Remove all jewelry.
    b. Wear goggles.
    c. Keep the work area clean.
    d. Keep all personnel clear of the work area.

2. PREOPERATIONAL CHECK

   a. Check all the wiring and the ground.

   b. Check the bit for sharpness.

   c. Check the bit for size and adaptability with the material to be cut.

3. OPERATIONAL PROCEDURES

   a. Locate and mark the position of the blade.

   b. Position the tile.

   c. Drill the hole.

4. POST-OPERATIONAL CHECK

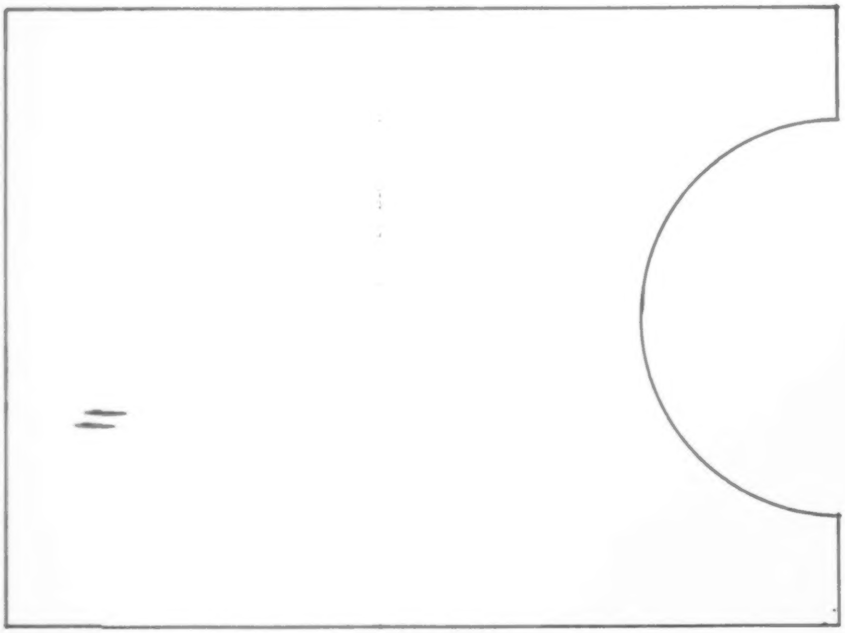
   a. Disconnect the power supply.

   b. Visually inspect the drill and bit.

   c. Clean the drill and work area.

TILE NIPPERS

Using the tile nippers, shape a ceramic tile to fit around a pipe as illustrated.



Tile Shaped to Fit Around a Pipe

HOLE BREAKER

1. Mark the hole to be cut.
2. Seat the tile firmly in the hole breaker.
3. Tighten the clamps against the tile evenly.
4. Give the tile a sharp blow with the tile hammer.
5. Use the chisel end of the tile hammer to shape the hole.

LAYOUT AN AREA FOR WALL TILE APPLICATION

OBJECTIVE

Working as a member of a team, layout an area for tile and determine the number of tiles required. The completed area must be ready for the application and the quantity of tile determined. Instructor assistance may be provided for most parts of the task.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-5	1/student
WB J3ABR55231 000-III-5-P2	1/student
Mason hand tools	1/student

MISSION I

PROCEDURE

Working as a member of a team, layout an area for tile and determine the number of tiles required. The completed area must be ready for the application and the quantity of tile determined. Instructor assistance may be provided for most parts of the task.

1. Inspect the selected surface for holes, cracks, ridges, stains, oil and waxes.
2. Repair the cracks and fill the holes with an appropriate patch material.
3. Remove the stains, oils, and waxes with an appropriate cleaning agent.

   NOTE: Wear proper protective devices and insure adequate ventilation.
4. Remove high spots and ridges from a mortar wall with a rubbing brick.
5. Sweep down the surface to remove sand and other loose particles.
6. List the following information:
   a. Total area to be covered is ______________________ sq. ft.
   b. Size of tile is ______________ X ________________.
   c. Size of base cove ______________ X ______________.
   d. Size of cap __________________ X ________________.

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7. Compute the number of ceramic tile required to cover the wall specified by your instructor. Use a piece of scratch paper and record your answers below.

a. Number of base cove tile ____________________

b. Number of flat tile ____________________

c. Number of cap tile ____________________

d. Number of outside corner tile ____________________

e. Number of inside corner tile ____________________

8. Run a level line identifying the top of the base cove (height of the cove plus the floor tile thickness).

9. Run a plumb line to provide a vertical reference.

10. Determine the number of tile to be cut and the size.

INSTALLING WALL TILE

OBJECTIVE

Given wall tile, adhesive, and a prepared area, apply the adhesive and tile to a specified area. The tile must be installed plumb and level, adhere to the surface, and present a pleasing appearance. Instructor assistance may be provided for most parts of the task.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-5	1/student
WB J3ABR55231 000-III-5-P3	1/student
Tile saw	1/12 students
Tile cutter	1/4 students
Mastic trowel	1/4 students
Mason hand tools	1/student
Tile	1/12 students
Mastic	1/12 students

MISSION I

PROCEDURE

Given wall tile, adhesive, and a prepared area, apply the adhesive and tile to a specified area. The tile must be installed plumb and level, adhere to the surface, and present a pleasing appearance. Instructor assistance may be provided for most parts of the task.

1. Obtain the necessary tools to be used for installing ceramic tile. Name these tools.

   ____

   ____

   ____

2. Obtain the other materials that must be used when laying tile. Name these materials. ______________________________

   ____

   ____

3. What is the clearance of the joint when setting tile on a wall? __________

   ____

4. Apply mastic.

5. Set base cove to reference line; space tile and level.

6. Set first row of tile.

7. Continue tile installation. Check each row for levelness, plumb and spacing. Trim corner tile to fit.

8. Beat in tile to form smooth uniform tile surface. Straighten and space tile.

9. Remove mastic which may have smeared over tile surface.

10. Clean the tools and work area.

11. Return the tools and equipment to the storage area.

LAYOUT AN AREA FOR FLOOR TILE APPLICATION

OBJECTIVE

Working as a member of a team, layout and determine the number of floor tile for an area. The completed area must be ready for floor tile application and the total number of tile determined. Instructor assistance may be provided for most parts of the task.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-5	1/student
WB J3ABR55231 000-III-5-P4	1/student
Mason hand tools	1/student

MISSION I

PROCEDURE

Working as a member of a team, layout and determine the number of floor tile for an area. The completed area must be ready for floor tile application and the total number of tile determined. Instructor assistance may be provided for most parts of the task.

1. Repair or level the floor.

   a. Fill low or uneven spots

   b. Remove high spots and ridges

2. Sweep down the surface to remove sand and other loose particles.

3. List the following information

   a. Total area to be covered is ____________________ sq. ft.

   b. Size of tile is ________________ X __________________.

4. Compute the number of floor tile required to cover the floor specified by your instructor.

   a. Total number of tile

5. Measure and mark the center of both walls.

6. Snap a chalk line across both the length and width.

7. Determine the amount of tile to be cut and the size.

INSTALLING FLOOR TILE

OBJECTIVE

Given floor tile, adhesive, and a prepared area, apply the adhesive and floor tile to a specified area. The tile must be leveled and spaced, adhere to the surface, and present a pleasing appearance. Instructor assistance may be provided for most parts of the task.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-5	1/student
WB J3ABR55231 000-III-5-P5	1/student
Tile saw	1/12 students
Mason hand tools	1/student
Tile	1/12 students
Mastic	1/12 students

MISSION I

PROCEDURE

Given floor tile, adhesive and a prepared area, apply the adhesive and floor tile to a specified area. The tile must be leveled and spaced, adhere to the surface, and present a pleasing appearance. Instructor assistance may be provided for most parts of the task.

1. Obtain the necessary tools for installing quarry tile.

   Name these tools. ____

   ____

2. Obtain the other materials that must be used when laying tile. Name these materials. ____

3. Apply the adhesive

NOTE: The mastic may be applied to the entire quarter to be tiled. Begin in the corner and work to the center of the room.

NOTE: If cement mastic is used, the tile base must be prepared properly.

4. Lay the first row of tile in line with the reference.

5. Lay each succeeding row. Properly space and align with each row previously installed.

6. Pound on each tile to achieve a level and uniform surface.
7. Remove any excessive mastic that might have smeared over the surface.
8. Clean the tools and work area.
9. Return all the tools and equipment to the storage area.

FINISHING AND CLEANING TILE SURFACES

OBJECTIVE

Given tools and materials, grout tile joints to specified depth and clean excess grout from the surface. Finished work must present a pleasing appearance and the joints filled to the specified depth and excess grout removed. Instructor assistance may be provided for most parts of the task.

EQUIPMENT	BASIS OF ISSUE
SG J3ABR55231 000-III-5	1/student
WB J3ABR55231 000-III-5-P6	1/student
Mason hand tools	1/student
Rags (polishing)	1/student
Grout	1/student

MISSION I

PROCEDURE

Given tools and materials, grout tile joints to specified depth and clean excess grout from the surface. Finished work must present a pleasing appearance and the joints filled to the specified depth and excess grout removed. Instructor assistance may be provided for most parts of the task.

1. Measure the amount of dry grout mix required.

2. Remove the large particles from the dry grout mix.

   NOTE: If these particles can be broken up easily between the fingers, they can be used.

3. Sift the grout through a screen.

4. Why is Step 3 important? ______________________________

5. Mix the grout to the proper consistency.

   a. What is the proper consistency for tile grout? ______________

   b. Add the water very slowly to keep from getting the grout too thin.

6. Apply the grout to the tile joints.

7. Allow the grout to dry at least 30 minutes.

8. Remove the grout film. Explain the best method of accomplishing this task.

9. Polish the tile surface. Explain the best method of accomplishing this task.

10. Clean the tools and work area.

11. Return all the tools and equipment to the storage area.